

TABLE OF CONTENTS OF SPECIAL PROVISIONS

Note: This Table of Contents has been prepared for the convenience of those using this contract with the sole express purpose of locating quickly the information contained herein; and no claims shall arise due to omissions, additions, deletions, etc., as this Table of Contents shall not be considered part of the contract.

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June 22, 2016
FEDERAL AID PROJECT NO. N/A
STATE PROJECT NO. 301-170

Noroton Heights Railroad Station Platform Replacement

Town of Darien
Federal Aid Project No. N/A

The State of Connecticut, Department of Transportation, Standard Specifications for Roads, Bridges and Incidental Construction, Form 816, 2004, as revised by the Supplemental Specifications dated July 2015 (otherwise referred to collectively as "ConnDOT Form 816") is hereby made part of this contract, as modified by the Special Provisions contained herein. . The State of Connecticut Department of Transportation's "Construction Contract Bidding and Award Manual" ("Manual"), May 14, 2010 edition or latest issue, is hereby made part of this contract. If the provisions of this Manual conflict with provisions of other Department documents (not including statutes or regulations), the provisions of the Manual will govern. The Manual is available upon request from the Transportation Manager of Contracts. The Special Provisions relate in particular to the Noroton Heights Railroad Station Platform Replacement in the Town of Darien.

CONTRACT TIME AND LIQUIDATED DAMAGES

Four Hundred Ninety-Seven (497) calendar days will be allowed for completion of the work on this project and the liquidated damages charge to apply will be Two Thousand Seven Hundred Dollars (\$2,700.00) per calendar day.

NOTICE TO CONTRACTOR – PROJECT DESCRIPTION

The following describes, in general terms, work to be performed by the Contractor. It is not a comprehensive description of the Contract scope.

Existing Facility

Noroton Heights Railroad Station is a mainline commuter train station located in Darien, CT. It is bound to the north and south by Heights Street and Interstate 95, respectively, and to the east and west by Noroton Avenue and Hollow Tree Ridge Road, respectively. The existing station consists of the following elements:

1. Two platforms (eastbound and westbound) that are located directly opposite each other to the south and north of the four (4) mainline tracks. The eastbound (EB) platform is serviced by Track 4 and the westbound (WB) platform is serviced by Track 3;
2. A small Station Building to the North;
3. North and south parking areas with access to the eastbound and westbound platforms;
4. A pedestrian bridge providing platform-to-platform access.

Project Scope

The Project scope consists of the following:

1. Complete replacement of all platform double tee sections with concrete/steel platform sections, along with replacement of various other platform access structures;
2. Minor modifications to the existing platform pier bents remaining;
3. Construction of new concrete pedestals supporting the new platform sections;
4. Replacement of existing platform bearings;
5. Replacement of the EB platform pedestrian shelter.
6. Installation of a temporary shelter during Stage 1 to assure that access to the eastbound platform shelter is maintained at all times during construction;
7. Replacement of all platform guardrails and handrails, including those located on stairways, ramps, and landings;
8. Other platform appurtenances:

- a. The removal of, and transference to MNR, of the existing recycling centers;
- b. The procurement of new recycling centers for MNR installation;
- c. Removal and re-installation of platform lighting (including LED modifications), benches, and signage. The Contractor may be directed to replace some of these items in-kind depending on their physical condition;
- d. The removal and relocation of the electric control panel for the EB platform.

The existing WB platform Station Building, WB platform canopy structure, and overhead pedestrian bridge will not be affected by Project construction and will remain in use upon completion of construction.

Environmental work associated with this facility may include lead abatement as indicated in the NOTICE TO CONTRACTOR – HAZARDOUS MATERIALS INVESTIGATIONS.

NOTICE TO CONTRACTOR – RAIL FACILITY UPGRADE (SITE NO. 1)

The Contractor is hereby advised that the Major Lump Sum Item (MLSI) for this contract is defined and paid under ITEM #0063521A - RAIL FACILITY UPGRADE (SITE NO. 1). In general, the MLSI includes all work required for the replacement of the eastbound and westbound platforms, various other platform access structures, and platform appurtenances, including but not limited to Architectural, Electrical and Communications work, as shown on the Contract Plans. **The detailed elements of work that constitute the MLSI are listed in ITEM #0063521A - RAIL FACILITY UPGRADE (SITE NO. 1).**

All the CSI-formatted specifications contained in the contract documents apply to the Major Lump Sum Item (MLSI).

NOTICE TO CONTRACTOR – PRE-BID SITE VISIT

A Pre-Bid Site Visit will be held at 10:00 on July 22nd, 2016 at the Noroton Heights Railroad Station in Darien, CT. Prospective bidders shall park at the stations parking lot, and place a traffic cone in front of their vehicle to notify the parking authority not to ticket the vehicle. Prospective bidders will meet in front of the station building on the North lot, and be escorted through the station to the project site.

Work for this Project involves areas that are part of the railroad right-of-way and access to the area is restricted. Therefore, all bidders are strongly encouraged to attend this Pre-Bid Site Visit. **There will be no other opportunity afforded to bidders to inspect the Project site.**

The Pre-Bid Site Visit will include a review of the project site, of the limitations of operations, and of the necessary compliance with Metro-North Railroad requirements for the Project.

All attendees must bring hard hats, safety vests, safety glasses, and safety shoes to the site visit. No one will be allowed on the site visit without wearing this safety gear.

Those planning to attend must contact Mr. Philip J. Melchionne, Contract Section, by July 18th prior to the Pre-Bid Site Visit, at DOTContracts@ct.gov for confirmation. You must provide your name, name of firm, phone number, and number of attendees.

Bidders are advised that no questions will be entertained at the site visit. All questions generated, as a result of the site visit must be submitted no later than, 4:00 pm July 25th, 2016. Questions shall be submitted via Q&A Portal (<http://dot-contractsqanda.ct.gov/Default.aspx>) faxed questions will no longer be accepted.

NOTICE TO CONTRACTOR – PRE-BID QUESTIONS AND ANSWERS

Questions pertaining to DOT advertised construction projects must be presented through the CTDOT Pre-Bid Q and A Website. The Department cannot guarantee that all questions will be answered prior to the bid date. **PLEASE NOTE - at 12:01 am, the day before the bid, the subject project(s) being bid will be removed from the Q and A Website, Projects Advertised Section, at which time questions can no longer be submitted through the Q and A Website. At this time, the Q and A for those projects will be considered final, unless otherwise stated and/or the bid is postponed to a future date and time to allow for further questions and answers to be posted.**

If a question needs to be asked the day before the bid date, please contact the Contracts Unit staff and email your question to dotcontracts@ct.gov immediately.

Contractors must identify their company name, contact person, contact email address and phone number when asking a question. The email address and phone number will not be made public.

The questions and answers (if any) located on the Q and A Website are hereby made part of the bid/contract solicitation documents (located on the State Contracting Portal), and resulting contract for the subject project(s). It is the bidder's responsibility to monitor, review, and become familiar with the questions and answers, as with all bid requirements and contract documents, prior to bidding. By signing the bid proposal and resulting contract, the bidder acknowledges receipt of, and agrees to the incorporation of the final list of Q and A, into the contract document.

Contractors will not be permitted to file a future claim based on lack of receipt, or knowledge of the questions and answers associated with a project. All bidding requirements and project information, including but not limited to contract plans, specifications, addenda, Q and A, Notice to Contractors, etc., are made public on the State Contracting Portal and/or the CTDOT website.

NOTICE TO CONTRACTOR – CONTRACT DRAWING NUMBERING

The sheet numbering format for the State Project No. 0301-0170 contract drawings is as follows:

The sheet numbers consist of the two digit numerical designation for the Subset Number, followed by a period and the two digit numerical designation for the Sheet Number in the Subset. For example, the sheet number 01.01 is for Subset 01, Sheet Number 01.

NOTICE TO CONTRACTOR – CONTRACTOR PARKING

The Contractor is hereby advised that there are limited areas available for employee parking adjacent to the various construction locations within and adjacent to the project limits. At no time shall parked or stored vehicles used for and by construction personnel impinge on roadway traffic operations, pedestrian access and/or access and egress to local businesses and other adjacent properties. The Contractors parking arrangements are subject to all local parking regulations. The Contractor must also conform to the requirements of the Special Provision “Article 1.07.07 – Legal Relations and Responsibilities/Public Convenience and Safety”.

The Contractor must submit to the Engineer for review and approval any areas he intends to use for parking. In addition to review and approval by the Engineer, potential sites to be obtained by the Contractor from private owners must be submitted to the Town of Darien for approval. The Contractor must submit verification of approval to the Engineer prior to use.

The Contractor may be required to shuttle employees to the project site from an off-site/remote parking facility, if required, at his own expense. There will be no direct payment for employee parking under the contract.

NOTICE TO CONTRACTOR – SITE CLEANLINESS

The Contractor is hereby notified that the all areas utilized for construction activities including all onsite and offsite facilities shall be maintained so as to be free of rubbish, trash and deleterious construction debris at all times. The use of covered and secured trash receptacles is required. All receptacles will be regularly emptied and maintained.

There will be no direct payment for maintaining the site cleanliness of the construction areas under the contract.

NOTICE TO CONTRACTOR – PUBLIC UTILITY PLANS

The Contractor's attention is hereby directed to the fact that included in the plans are plan sheets furnished to the State by various utility companies affected by the proposed construction. These sheets are not intended to show all proposed work required by the utility installations to be completed by the various utility companies or municipal authorities, before, during or after the life of this contract. It may be possible that in addition to the work indicated on these plans, the utility companies and authorities may make adjustments to and/or remove installations other than those indicated on the plans or may install facilities not indicated.

NOTICE TO CONTRACTOR – VERIFICATION OF PLAN DIMENSIONS AND FIELD MEASUREMENTS

The Contractor is responsible for verifying all dimensions before any work is begun. Dimensions of the existing structures shown on the plans are for general reference only; they are not guaranteed. The Contractor shall take all field measurements necessary to assure proper fit of the finished work and shall assume full responsibility for their accuracy. When shop drawings and/or working drawings based on field measurements are submitted for approval and/or review, the field measurements shall also be submitted for reference by the reviewer.

In the field, the Contractor shall examine and verify all existing and given conditions and dimensions with those shown on the plans. If field conditions and dimensions differ from those shown on the plans, the Contractor shall use the field conditions and dimensions and make the appropriate changes to those shown on the plans as approved by the Engineer. All field conditions and dimensions shall be so noted on the drawings submitted for approval.

There shall be no claim made against the Department by the Contractor for work pertaining to modifications required by any difference between actual field conditions and those shown by the details and dimensions on the contract plans. The Contractor will be paid at the unit price bid for the actual quantities of materials used or for the work performed, as indicated by the various items in the contract.

NOTICE TO CONTRACTOR – MEASUREMENT AND PAYMENT

This Project is being bid with both lump sum and unit price items. The bid items include unit price and lump sum items which are IN ADDITION TO the Major Lump Sum Item (MLSI) of the Project. These separate items will be measured for payment on a unit price or lump sum basis (whichever is applicable) for which a separate bid price is required, at the quantities as indicated in the Bid Proposal Form. Each item to be measured is more specifically described in a corresponding Form 816 Standard Specification related to that item, or a special provision, as applicable. The MLSI of the Project is described in “Item #0063521A – Rail Facility Upgrade (Site No. 1)”. Refer to “Notice to Contractor – Rail Facility Upgrade (Site No. 1)” for additional information.

Standard Form 816 Items are referenced by their standard item numbers. Refer to the applicable article of Form 816 for the requirements for this item. Special Provisions included in this Contract are referenced by their item number followed by an "A" suffix. Refer to the Special Provisions contained within this Contract for requirements for this item.

All work depicted on the Contract Plans and described in the Contract Specifications, including mobilization, is included in the MLSI of the Project, with the exception of the unit price or other lump sum items listed in the Bid Proposal Form. Any work incidental to an item which is not specifically described or included in the item, but which is required for performance and completion of the work required under the Contract, is included in the MLSI.

The items of work included and paid for under the MLSI are specifically indicated in “Notice to Contractor – Rail Facility Upgrade (Site No. 1)”.

NOTICE TO CONTRACTOR – STANDARD SPECIFICATIONS

Whenever and wherever "ConnDOT Form 816," "Form 816," "Standard Specifications" are referenced herein, this shall mean and refer to "State of Connecticut, Department of Transportation, Standard Specifications for Roads, Bridges, and Incidental Construction, Form 816", including the Supplemental Specifications.

NOTICE TO CONTRACTOR – GENERAL REQUIREMENTS AND COVENANTS OF THE CONTRACT

Division I of the document entitled “State of Connecticut, Department of Transportation, Standard Specifications for Roads, Bridges, and Incidental Construction, Form 816, 2004,” including the Division I Supplemental Specifications, shall collectively be known as the “General Requirements and Covenants of the Contract.”

The Contractor is hereby advised of the potential for conflicts between provisions contained within Section 1.20 of the Form 816 with other Division I Sections of the Form 816. Where the aforementioned conflicts occur, Section 1.20 shall at all times govern.

**NOTICE TO CONTRACTOR – FORM 816 REFERENCES ON
STANDARD DRAWINGS**

The Contract includes standard Connecticut Department of Transportation drawings with material and pay limit references to Form 816. For work shown on these drawings that is included under the Major Lump Sum Item (MLSI) for the Project, the Contractor shall disregard these references.

Pay limits for unit price and lump sum items, other than the MLSI, shall be in accordance with “Method of Measurement”, and “Basis of Payment” of the appropriate special provision section.

For all materials that have a probability of containing asbestos, the Contractor shall provide a certification letter on the manufacturer's letterhead along with the regular submittal package to prove that asbestos is not contained in the materials. These materials will not be approved without the required manufacturer certification letter. The manufacturer certification letter shall be formatted in the following manner:

Project Title and Number

[Signature:] _____
[Name of authorized signatory]
[Title]

1. CSI Section 07 92 00 - JOINT SEALANTS
2. CSI Section 07 92 05 - CONCRETE OVERLAY JOINT
3. CSI Section 07 92 10 – FIXED PLATFORM JOINT
4. CSI Section 07 95 10 - LONGITUDINAL JOINT SYSTEM

Failure of the Contractor to provide the required documentation will result in the immediate removal of the material from the Project by the Contractor at its expense. The Contractor shall be responsible for all costs incurred as a result of such required action, and replacements thereof, in order to complete the Project.

Any asbestos containing material that is found to have been installed as a result of work performed under this Contract will be required to be removed by the Contractor at its expense as soon as such determination is made. The Contractor shall also replace the removed material with appropriate material that is in compliance with the Contract. The Contractor is also responsible to pay for any asbestos testing charges the Department incurs in order to prove that the material contains asbestos fibers. This obligation will extend throughout the one-year warranty period after the issuance of the Certificate of Compliance.

The Contractor shall complete and sign the attached certification form assuring the Department that no asbestos-containing materials have been used in the construction of this Project. This form shall be submitted prior to the Semi-Final Inspection. The Certificate of Compliance will not be issued without this completed and signed certification form.

**CONTRACTOR CERTIFICATION:
RE/ ASBESTOS CONTENT OF MATERIALS**

State of Connecticut
Department of Transportation
PO Box 317546
Newington, CT 06131-7546

1. Project Number: _____
2. Project Name: _____
3. Contractor Name: _____
4. This is to certify that I have read, understood, and complied with the terms and conditions identified under the “NOTICE TO CONTRACTOR – POTENTIAL FOR ASBESTOS CONTAINING MATERIALS” included in this Contract.

I fully understand that it is the requirement of the Connecticut Department of Transportation that only materials that do not contain asbestos of any kind or amount are to be utilized in the construction of this Project.

I therefore certify that, to the best of my knowledge, all materials installed under this Contract are asbestos-free.

For the one-year warranty period after the issuance of the Certificate of Compliance, I agree to remove any asbestos-containing material identified by the Connecticut Department of Transportation and reinstall an approved, non-asbestos-containing material that is in compliance with the original Contract at no additional cost to the State.

5. Date of Certificate of Compliance: _____
6. Date of the Asbestos Certification: _____
7. Signature of Authorized Party Agreeing to the Terms & Conditions Identified Herein & as Further Stated in the Contract:

Signature

Title

Printed Name

Date

NOTICE TO CONTRACTOR – OFF-SITE STAGING AND STORAGE

The Contractor is hereby advised that due to the restrictive Project Limits and the need to maintain the maximum number of parking spaces for Metro-North Railroad and ConnDOT Employees, and other operational constraints identified in the Contract, off-site staging and storage of materials and equipment will be required. Arrangement for off-site staging and storage of materials and equipment shall be the responsibility of the Contractor. The Contractor shall restrict its operations, including the need for parking for its employees, subcontractors, and the Engineer to the Project Limits depicted on the Contract plans. The Contractor shall bid the Project accordingly.

The Contractor shall coordinate with the town of Darien the availability of storage space during time of construction. Please note that the availability of the storage space is not guaranteed and the Contractor shall bid accordingly. Any storage by the Contractor in this area shall be in a locked container unit.

NOTICE TO CONTRACTOR – COLD WEATHER CONCRETE ACTIVITIES

The Contractor is hereby advised of the potential need for cold weather concrete activities. The Contractor shall strictly adhere to all required cold weather concrete procedures as specified within the Contract and conduct its activities accordingly. The Contractor shall bid the Project accordingly.

NOTICE TO CONTRACTOR – PROJECT PHASING REQUIREMENTS

The construction of the Improvements to the Noroton Heights Railroad Station shall be phased so that all Railroad station operations and facilities will continue as normal without interruption unless specifically detailed in the Contract documents. The Contractor is notified that crane operations must be scheduled during the allowable outages listed in NOTICE TO CONTRACTOR – WORK ON RAILROAD PROPERTY, to reduce the impact to railroad operations and passenger drop off.

The Contractor is responsible for developing its own phasing plan for the Engineer's approval for the Project work, based on the staging plans shown on the contract documents.

Staging and project phasing shall account for all track/catenary outages which shall be coordinated with Connecticut Department of Transportation and Metro North Railroad in accordance with NOTICE TO CONTRACTOR – WORK ON RAILROAD PROPERTY.

Although the Contractor is responsible for developing its own phasing plan, the Contractor shall comply with the milestones, and the specific number of days allowed for milestone completions, stipulated in Contract Time and Liquidated Damages.

Coordination

- The Contractor shall coordinate construction activities with Metro North Operations, Metro North Power Department, and other CTDOT construction projects.
- The Contractor shall be aware that before, during, and after the completion of the project, there are several other ongoing independent Department construction projects adjacent to the project limits. These projects include but shall not be limited to those listed in NOTICE TO CONTRACTOR - WORK ON RAILROAD PROPERTY. The Contractor shall coordinate their work with these other Department construction projects.
- Except as specifically allowed by the Contract, Metro-North operations (including yard operations of trains, track systems, power distribution, and communications) and other systems will remain active without interruption for the duration of this Contract. Refer to NOTICE TO CONTRACTOR – WORK ON RAILROAD PROPERTY for allowable track/catenary outages.

Project Schedule

- The Contractor shall structure its project CPM schedule to clearly identify the activities leading up to platform demolition and construction, pier modifications, bearing replacement, platform shelter replacement, and replacement of platform appurtenances, along with the milestones listed under CONTRACT TIME AND LIQUIDATED DAMAGES.

- The Contractor shall coordinate their schedule with work on other department projects as directed by the Engineer. Work shall also be staged to coordinate with other Department projects as directed by the Engineer.
- The Contractor shall coordinate their schedule with the Department and Metro North Railroad for track and/or catenary outages required for construction. Refer to NOTICE-TO-CONTRACTOR – WORK ON RAILROAD PROPERTY for allowable track/catenary outages.

NOTICE TO CONTRACTOR – LIMITATION OF CONTRACTOR OPERATIONS

1. In order to maintain the maximum number of parking spaces available to Railroad employees, the Contractor shall restrict its operations solely to the areas where construction activities included in this Project are shown on the Contract Plans. The Contractor shall not use station parking spaces outside of these areas for storage of equipment or materials or for the parking of the Contractor's or Subcontractor's vehicles. If parking for the Contractor's needs is not available within said area, the Contractor shall be responsible for arranging off-site parking and the shuttling of employees to and from the work area.

The Contractor shall access the station via the locations indicated on the plans. The public entrances shall not be used.

The Contractor is advised that other contractors may be working within the station adjacent to and concurrent with this project. The Contractor must share access and work areas with other such contractors.

See NOTICE TO CONTRACTOR - LOCATING TRAILERS ON THE PROJECT SITE for restrictions on locating Contractor construction trailers.

2. Prior to commencing construction activities, the Contractor shall verify the location of underground, structure mounted, and overhead utilities.

The Contractor shall bid the Project accordingly.

NOTICE TO CONTRACTOR – ENGINEER OCCUPANCY

The Engineer, Department personnel, and Metro-North Railroad personnel will occupy the Project Site during the entire construction period.

The Engineer reserves the right to occupy and to place and install equipment in completed areas of the Facility, prior to Final Inspection and the issuance of the Certificate of Compliance provided that such occupancy does not interfere with completion of the Project. Such placing of equipment and partial occupancy shall not constitute acceptance of the total Project. The Contractor shall allow and cooperate with such occupancy at no additional cost to the State.

1. The Engineer shall obtain from the Contractor written approval of such occupancy. The Engineer shall determine whether such occupancy or use is possible and, if so, will make arrangements for holding a job inspection with representatives of the Department and the Contractor.
2. Based on the inspection, a "Punch List" of outstanding or unacceptable work shall be developed.
3. The Contractor shall prepare a letter to the Engineer granting occupancy. The letter granting such occupancy shall state the terms and conditions of occupancy and include the status of completion of "Punch List" items.
4. Subsequent to the receipt of the letter granting occupancy, the Engineer shall notify the Contractor in writing that fire insurance coverage has been requested, and the effective date the Contractor may cancel the fire insurance coverage normally carried on the building by it.
5. Prior to partial Engineer occupancy, all mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy the Engineer will provide operation and maintenance of mechanical and electrical systems in occupied portions of the building.

NOTICE TO CONTRACTOR – LOCATING TRAILERS ON THE PROJECT SITE

The Contractor is hereby advised that due to the limited space available within the station, and multiple construction contracts taking place in the station, the Contractor will be limited to locating Contractor office trailers and portable bathroom facilities within the limits of the Project work area. If the Contractor's requirement for trailer space cannot be accommodated within the designated area, the Contractor shall be responsible for locating Contractor office trailers off site at no expense to the Department.

The Contractor shall locate the Construction Field Office provided for use by the Department in the area indicated in the Contract Documents or as directed by the Engineer.

The Contractor shall bid the project accordingly.

NOTICE TO CONTRACTOR – EARLY SUBMITTALS

The Contractor is hereby advised that the Department has identified the potential need to order certain materials and equipment, and thereby submit certain submittals for approval early in the construction process to ensure the Project is completed within the allowable Contract Time. Submittals shall be in accordance with Form 816 Article 1.20-1.05.02. The following items have been identified as possibly requiring early ordering thereby requiring early submission of shop drawings and product data, including color selection charts and samples:

General

1. General Railroad Liability Insurance
2. Railroad safety Plan
3. Phasing Plan (Refer to NOTICE TO CONTRACTOR – PROJECT PHASING REQUIREMENTS)

Special Provisions/Contract Items

4. ITEM #0971001A - MAINTENANCE AND PROTECTION OF TRAFFIC
5. ITEM #1005600A - LED LUMINAIRE

CSI-Formatted Specifications

6. SECTION 03 41 01 – PRECAST STRUCTURAL CONCRETE
7. SECTION 03 41 05 – PLATFORM SECTION (Items: Structural steel; precast platform panels)
8. SECTION 34 82 10 – STEEL LAMINATED ELASTROMERIC BEARINGS

The following items have been identified as possibly requiring early submission for purposes of project coordination and project work scheduling:

1. Baseline Critical Path Schedule
2. Contractor's Submittal Schedule
3. Health and Safety Plan
4. Disposal of Controlled Material

Items requiring approval by Metro-North Railroad may require early submittals due to the extended review periods allowed to those agencies. Refer to NOTICE TO CONTRACTOR - METRO-NORTH RAILROAD SUBMITTALS for additional information.

The lists above are not intended to be all-inclusive and do not relieve the Contractor from coordinating the activities of its subcontractors and suppliers. The Contractor will not be permitted to perform any physical work on the Project without the approval of the required submittals. Failure to properly plan for long lead items within the Contract schedule will not be justification for additional construction time.

06/09/16

It is recommended that the Contractor identify early in the construction sequencing process the subcontractors and suppliers associated with long lead-time items and submit the appropriate shop drawings and supporting data, including color selection charts and samples, for review upon Notice to Proceed.

NOTICE TO CONTRACTOR – SUBMITTALS

Submittal Preparation and Processing:

The Contractor shall provide the Designer with complete submittal packages (Product Data, Shop Drawings, Samples, and Quality Assurance Submittals, as applicable) for individual elements of Project work for a concurrent review of all information. Incomplete submittal packages will be returned to the Contractor without being reviewed.

Transmittal of Submittals:

Unless otherwise stipulated, all submittals requiring review for conformance with the Contract shall be transmitted electronically to Parsons Brinckerhoff, 500 Winding Brook Drive, Glastonbury, CT 06033, Attention: Mr. Thomas Laliberte, P.E.

Electronic copies of all transmittal letters shall be sent to the Connecticut Department of Transportation Design and Construction representatives as well as Metro-North Railroad.

At the time the foregoing submission is made to the Designer, electronic copies of all submittals requiring Metro-North Railroad review for conformance with the Contract shall be routed directly to Metro-North Railroad. See NOTICE TO CONTRACTOR - METRO-NORTH RAILROAD SUBMITTALS for submittals requiring Metro-North Railroad approval.

Submittals requiring review for conformance with the Contract that shall be electronically submitted directly to the Engineer in lieu of the Designer are listed below. Electronic copies of the transmittal letters shall be sent to the Connecticut Department of Transportation Design representatives and Metro-North Railroad.

1. Concrete Mix Design Certifications.
2. Asphalt Mix Design Certifications
3. Erosion Control Plan and Materials
4. Demolition Plan
5. Disposal Plan
6. Construction Staging Plan
7. Structure Erection Plans including Erection Methods and Procedures, crane lift and rigging plans stamped by a Professional Engineer licensed in the State of Connecticut.
8. Dewatering Connection Plan
9. Maintenance and Traffic Protection Plan
10. Safety and Security Plan

Submittals requiring review for conformance with the Environmental Contract work that shall be electronically submitted directly to the Assistant District Engineer in lieu of the Designer are listed below. Electronic copies of the transmittal letters shall be sent to the Manager of Facilities and Bridges.

1. Health and Safety Plan.
2. Disposal Plan and Site.
3. Lead Abatement Plan.

Samples: Where Samples are for selection of color, pattern, texture or similar characteristics from a range of choices, submit 4 full sets of the standard and custom choices for the material or product. Where Samples illustrate assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit 1 sample (or set, if applicable).

The Designer will return electronic copies marked with action taken and corrections or modifications required. The Designer will return one set of samples marked with the action taken. The set of samples shall be maintained at the Project site when returned.

Maintenance Manuals and Warranties: Maintenance manuals and warranties shall be submitted both electronically and in hard copy form. Refer to NOTICE TO CONTRACTOR – CLOSEOUT DOCUMENTS for further requirements. Maintenance manuals and warranties will not be returned unless they are rejected.

NOTICE TO CONTRACTOR – METRO-NORTH RAILROAD SUBMITTALS

The submittals associated with the specifications listed below, that require Metro-North Railroad review for conformance with the Contract, shall be clearly labeled “Requires Metro-North Review” on the transmittal when submitted electronically. Hard copies of all final approved submittals shall be hand delivered or sent by mail directly to Metro-North Railroad, 52 Water Street, 3rd Floor, Bridgeport R.R. Station, Bridgeport, CT 06604-4315 Attention: Mr. David B. Willard. Review of the following submittals may take up to 60 days in accordance with CTDOT Form 816 Article 1.20-1.05.02. The Contractor shall bid the project accordingly.

Special Provisions

1. ITEM #1003926A - REINSTALL LIGHT POLE
2. ITEM #1005600A - LED LUMINAIRE
3. ITEM #1020037A - TEMPORARY LIGHTING

CSI-Formatted Specifications

4. SECTION 09 61 40 - DETECTABLE / TACTILE WARNING SURFACES
5. SECTION 10 14 00 - IDENTIFYING DEVICES
6. SECTION 13 34 19 - PRE-ENGINEERED PLATFORM SHELTERS
7. SECTION 23 82 46 - ELECTRIC UNIT HEATERS
8. SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
9. SECTION 27 51 16 - PUBLIC ADDRESS AND MASS NOTIFICATION SYSTEMS

Operation and Maintenance Manuals:

10. All Operation and Maintenance Manuals listed in NOTICE TO CONTRACTOR – CLOSEOUT DOCUMENTS.

NOTICE TO CONTRACTOR – PRE-INSTALLATION MEETINGS

The Engineer will conduct a pre-installation meeting at the Project Site before each of the following construction activities:

1. Platform selective demolition (Form 816 Article 1.20-1.08.03 – Prosecution of Work, Subsection 4 – Selective Demolition).
2. Paving HMA S0.375
3. SECTION 03 30 00 – CAST-IN-PLACE CONCRETE
4. SECTION 03 53 20 – MICROSILICA CONCRETE OVERLAY
5. SECTION 07 92 00 – JOINT SEALANTS
6. SECTION 09 61 40 – DETECTABLE/TACTILE WARNING SURFACES

The above list may not be all-inclusive and does not relieve the Contractor from its responsibility to provide pre-installation meetings that are required under other Contract provisions.

NOTICE TO CONTRACTOR – CLOSEOUT DOCUMENTS

General: The list of special provisions (including CSI-formatted specifications) in the Table below may not be all-inclusive and does not relieve the Contractor from its responsibility to provide spare parts, operation and maintenance manuals, training, and warranties that are required under other Contract provisions.

This Table will be forwarded to Mr. Richard Jankovich, Office of Rails, for concurrence prior to the Semi-Final Inspection.

Spare Parts: The Contractor shall deliver spare parts on products listed in the Table below to the Project Site, to a location(s) determined by the Engineer.

Operation and Maintenance Manuals: Operation and Maintenance Manuals shall be formatted in accordance with Form 816 Article 1.20-1.08.14. Submit 4 copies of each manual to the Designer. The Designer, Metro-North Railroad, and Mr. Richard Jankovich, Office of Rails, will review the manuals for conformance to the Contract. The manuals will be processed in accordance with Form 816 Article 1.20-1.05.02, with 3 copies being forwarded to Mr. Richard Jankovich, Office of Rails, and one copy being sent to the Engineer.

Materials and Finishes Maintenance Manual: The Contractor shall provide complete information in the materials and finishes manual on products listed in the Table below.

Equipment and Systems Maintenance Manuals: The Contractor shall provide complete information in the equipment and systems manual on products listed in the Table below.

Training: The Contractor shall provide training on products listed in the Table below. All training sessions shall be videotaped by the Contractor, with three (3) High Definition DVD copies forwarded to Mr. Richard Jankovich, Office of Rails, and one copy provided to the Engineer. The DVDs provided by the Contractor shall not be copy-protected in order to allow future copying and distribution by the Department as needed. Each DVD shall be labeled with the project name, name of the videographer, name of the Contractor, the date the video was recorded, and the location where the videotaping occurred. **Please note: The videotaping shall be performed by a professional videographer, hired by the Contractor, of established reputation who has been regularly engaged as a professional videographer for not less than three years.**

Training Instructors shall be a Manufacturer's Representative or Applications Engineer fully qualified in the operation, troubleshooting and maintenance procedures for the equipment or systems being covered. Sales Representatives or others possessing only general knowledge of the equipment or systems will not be acceptable.

The following format shall be used to schedule, perform, document and evaluate the required training sessions:

1. The Contractor shall submit a separate Training Form for each training session required by the Contract Documents. This form shall be submitted a minimum of fourteen (14) calendar days in advance of the proposed training session.
2. The Contractor shall complete the first section of the form including the proposed training session date, name of instructor(s), and proposed length (time) of the session(s). Also, attach an Agenda indicating the format of the training session and listing any handouts that will be provided.
3. During the training session, the Contractor shall have all in attendance sign in the third section of the Training Form. Attach additional pages if necessary. The Contractor shall then forward the Training Form to the Engineer.

Training sessions shall cover the following items:

1. Review of Operations and Maintenance Manuals including all system drawings
2. Overview of system components
3. System operation under normal conditions
4. System operation under abnormal conditions
5. Emergency procedures
6. Troubleshooting procedures
7. Maintenance and Repair procedures
8. Questions

The Contractor is responsible for all costs associated with travel to and from the Training Facility, lodging during the training session and tuition & materials.

Training sessions for similar items where the class membership is likely to be the same may be combined with the advance approval of the Engineer.

Warranties: Submit 4 copies of written warranties, including special warranties to the Designer. The Designer and Mr. Richard Jankovich, Office of Rails, will review the warranties for conformance to the Contract. The warranties will be processed in accordance with Form 816 Article 1.20-1.05.02, with 3 copies being forwarded to Mr. Richard Jankovich, Office of Rails, and one copy being sent to the Engineer.

The Contractor shall provide special warranties on products and installations listed in the Table below. Item specifications may include additional information that is specific to the equipment and is required to be submitted.

Special Provision (including CSI-formatted Specifications)	Special Warranties	Spare Parts	Training	Operation and Maintenance Manuals
ITEM #1005600A - LED LUMINAIRE	X			
SECTION 05 52 00 - METAL HANDRAIL AND GUARDRAIL SYSTEMS	X			X
SECTION 05 55 13 - METAL STAIR TREADS	X			
SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM	X			X
SECTION 07 92 00 - JOINT SEALANTS	X		X	
SECTION 08 42 13 - ALUMINUM-FRAMED ENTRANCES	X		X	X
SECTION 08 80 00 - GLAZING	X			X
SECTION 10 14 00 - IDENTIFYING DEVICES	X		X	X
SECTION 12 93 40 - SITE FURNISHINGS	X			
SECTION 13 34 19 - PRE-ENGINEERED PLATFORM SHELTERS			X	X
SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS				X
SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS				X
SECTION 26 27 26 - WIRING DEVICES				X
SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS		X		X
SECTION 27 51 16 - PUBLIC ADDRESS AND MASS NOTIFICATION SYSTEMS		X		X

NOTICE TO CONTRACTOR – WARRANTIES

Refer to NOTICE TO CONTRACTOR - CLOSEOUT DOCUMENTS for information related to warranties.

NOTICE TO CONTRACTOR – SAFETY & SECURITY PLAN

The Contractor is advised that certain safety and security related requirements are necessary for the prosecution of this contract. The Contractor's safety supervisor should be identified and responsible for the establishment and management of and compliance with all safety and security related issues. The Contractor is required to prepare a project specific Safety and Security Plan to be maintained in the Contractor's project office. This plan should recognize all other activities being performed in the station, though not under the direct control of the Contractor, including rail operations, maintenance and other construction activity. Along with the plan, in the Contractor's project office, the Contractor shall maintain documentation of their implementation, maintenance, inspection and updating of this plan. This plan is to be updated throughout the project, as determined by the Contractor, to reflect and incorporate changes in the project.

The Contractor shall submit monthly a safety status report that will reflect the Contractor's performance and compliance with the Safety and Security Plan requirements.

At a minimum, the Contractor shall prepare and maintain a safety log, reflecting the documentation of their compliance with the plan, at the Contractor's office; perform and submit hazard analyses, as necessary; conduct QA/QC of safety and security activities; develop a safety and security training program for employees and monitor compliance. The documentation should include the following: tool box safety meetings, crane safety inspections, MSDS data, training reports, first aid reports, up-dated list of emergency numbers, documentation of regular reviews and inspections, maintenance of current certifications and inspections, training, training procedures developed, readiness audits, documentation of the monitoring and compliance with criteria of the plan, daily reports of oversight of project inspections, identification and control of work place hazards, Personal Protective Equipment (PPE), hazardous materials, drug and alcohol testing procedures, safety and security inspections, maintenance on-site of all applicable publications referenced in all safety security specifications, maintenance of a ROW training log for all employees and copies of a log of all "Tool Box" safety meetings.

Assist CTDOT in its project safety and security certification, including but not limited to testing and validation in support of the Safety and Security Certification Program (SSCP); perform construction specification conformance checklist; identify safety and security test requirements; manage integrated tests for the SSCP; manage "open items" in the SSCP; verify operational readiness; and conduct final determination of project readiness and issue safety and security certification.

The Contractor is hereby notified that no separate pay item or additional time will be granted for this item's requirements. All durations for the activities noted above shall be considered when the Contractor develops a construction schedule. Additional administrative costs for security requirements, including but not limited to: the cost of the creating and preparing a safety and security plan, training program, log creation and maintenance, hazard analyses, and other associated activities shall not be paid for separately but shall be included in the general cost of the work.

NOTICE TO CONTRACTOR – SITE SECURITY AND ACCESS

During construction, the Contractor must adhere to all station security requirements. These requirements apply to the contractor, subcontractors, material and equipment suppliers, and any other related personnel working on the project. These security procedures are outlined in this specification section.

All employees of the Contractor and its subcontractors must obtain a photo identification security badge (badge) which shall be visible at all times. The Contractor shall be responsible for all employees and subcontractor badging requirements, including producing the badges, identification photographs, application forms, plus associated data management, archiving, and oversight. The Contractor shall appoint an “Authorized Security Supervisor” (Security Supervisor) to conduct these activities. The Security Supervisor will be dealing with sensitive security information and therefore shall not be a convicted felon. The Security Supervisor shall complete and sign the Authorized Security Supervisor Application (application provided at the end of this NTC) and submit it to the Engineer for approval. The Contractor shall also provide a criminal history report for the proposed Authorized Security Supervisor that will be reviewed and approved by the Engineer and Metro-North Railroad (MNR) security personnel. The report shall be generated by a company such as “ChoicePoint” that has been providing background checks in the industry for a minimum of one year. The Authorized Security Supervisor Application, along with the required criminal history report, shall be submitted to the Engineer for approval at the time of the Project Pre-Construction meeting.

The Contractor shall arrange for the same Security Supervisor to be available throughout the project duration. The Security Supervisor will take responsibility for all badging requirements for the Contractor and all subcontractor employees and shall coordinate these requirements with MNR and CTDOT security personnel. Particular tasks required of the Security Supervisor include:

The Security Supervisor shall issue and review all employee applications for security badges (application provided at the end of this NTC). The Security Supervisor shall verify all information supplied by the applicant on the Contractor Security Badge Application in addition to verifying other physical characteristics such as height, weight, and hair/eye color as they appear on the applicant’s photo identification. Once employee applications have been verified, the Security Supervisor shall create the badge and issue it to the applicant. The Security Supervisor shall be responsible for determining the duration the badge is required. Badges will be issued for the duration needed based on the approved construction schedule, or for one year, whichever is less. The Security Supervisor must maintain a database of all employees with badges, including application information, duration of badge, and current status of badge (actively being used or has been returned). This must be kept up to date, on a daily basis, and be available for immediate audit by MNR security personnel. The Security Supervisor shall provide all approved Security Badge Applications to MNR security personnel at the end of each day. Approved applications will be reviewed by MNR security personnel who will have the authority to revoke badges should it be determined necessary for any reason.

The badge shall be of plastic type, without smart chip for swipe access, shall be yellow in color and a minimum of 2" by 3" by 30 mils thick in size. The badge shall have a photo of the employee and the following information in this order:

Noroton Heights Railroad Station Platform Replacement (0301-0170)

Project Name (Coordinate with Engineer)

Photo of Employee

Name of Employee

Contractor / Subcontractors Name

Badge #

Expiration Date

The Statement "Contractor Employee" under the expiration date

The Contractor shall provide a badging unit capable of printing photo ID pictures directly onto a badge of the type and size indicated above. All text shall be a minimum of 1/8" high and employee photo shall be a minimum of 1" by 1 1/4".

The Contractor shall ensure that all employees wear their badge at all times, and that no employee is permitted to begin work until they are safety trained and have been issued badges. An outline of the photo identification badge procedure is included in this specification.

The Contractor shall be aware that access to the station, as indicated on the contract plans, will be limited to Contractor employees in passenger vehicles and two axle pick-up trucks only. All deliveries and commercial vehicles are required to enter via access points indicated on the contract plans. Delivery drivers are not required to have a badge.

The Contractor shall abide by all Safety Requirements as described in the NOTICE TO CONTRACTOR – WORK ON RAILROAD PROPERTY.

The Contractor shall abide by the following MNR/CTDOT Security Requirements:

- Obey all Federal, State, and Local laws and ordinances
- Comply with all traffic rules and regulations while on CTDOT property
- Obey all legal direction from MTA Police or other law enforcement organizations having jurisdiction on or about CTDOT property and facilities
- Comply with security rules and regulations contained in this contract and subsequent rules and regulations that may be issued from time to time.
- Pertaining to the scope of published security rules and regulations, obey direction from CTDOT/MNR security personnel who have jurisdiction at rail yards and facilities. Security personnel, including guards, have a responsibility to maintain a secure and safe work environment

- Contractors are not authorized to release security sensitive information or confidential information about construction projects without written authorization from the Engineer and MNR security personnel

The Contractor is hereby notified that no separate pay item or additional time will be granted for badging and other site security requirements. All durations for the activities noted above shall be considered when the Contractor develops a construction schedule. Additional administrative costs for security requirements, including the cost of the badging unit and supplies, shall not be paid for separately but shall be included in the general cost of the work.

Noroton Heights Railroad Station

Photo Identification Security Badge Procedure

This procedure is required to obtain a photo identification security badge for all employees involved in the construction of any of the Noroton Heights Railroad Station projects.

1. Contractor or subcontractor employee reports to the General Contractor's trailer to be processed for a photo identification security badge.
2. Proof of identification is required in the form of:
 - Valid U.S. / U.S. Territory / Canadian Driver's License
 - Valid Passport
 - Valid Government Photo ID
3. Proof of identification will be photocopied and attached to this application.
4. Application form is completed and signed by the employee.
5. Application is reviewed, and approved by, the General Contractor's Authorized Security Supervisor.
6. Photo identification security badge is issued to the employee.
7. Photo identification security badge must worn with issued breakaway lanyard.
8. If the photo identification security badge is lost or stolen it must be immediately reported to the General Contractor and a replacement badge will be issued.
9. Photo identification security badge must be surrendered at the end of the work assignment to the General Contractor.

01/18/16

NOROTON HEIGHTS RAILROAD STATION CONTRACTOR SECURITY BADGE APPLICATION

TO BE COMPLETED BY APPLICANT:

CONTRACTOR INFORMATION			
CONTRACTOR NAME		SUPERVISOR NAME	
BUSINESS ADDRESS (Number and Street)			
CITY		STATE	ZIP CODE (Last 4 digits are optional)
AREA CODE ()	PHONE NUMBER -		

EMPLOYEE INFORMATION				
EMPLOYEE NAME (Last)		(First)	(MI)	SUFFIX (JR., DR., II)
ADDRESS (Number and Street)				
CITY		STATE	ZIP CODE (Last 4 digits are optional)	
AREA CODE ()	PHONE NUMBER -		DATE OF BIRTH (MM/DD/YYYY)	
SIGNATURE		DATE (MM/DD/YYYY)		

TO BE COMPLETED BY AUTHORIZED SECURITY SUPERVISOR:

ACCEPTABLE PHOTO IDENTIFICATION		
<input type="checkbox"/> VALID U.S. / U.S. TERRITORY / CANADIAN'S DRIVER'S LICENSE <input type="checkbox"/> VALID PASSPORT <input type="checkbox"/> VALID GOVERNMENT PHOTO ID, SPECIFY _____		
IDENTIFICATION #	STATE ISSUED (IF APPLICABLE)	EXPIRATION DATE
<input type="checkbox"/> APPROVED		
BADGE # ISSUED	EFFECTIVE DATE (MM/DD/YYYY)	EXPIRATION DATE (MM/DD/YYYY)
<input type="checkbox"/> DENIED		
REASON		
SIGNATURE OF AUTHORIZED SECURITY SUPERVISOR		DATE (MM/DD/YYYY)

01/18/16

NOROTON HEIGHTS RAILROAD STATION AUTHORIZED SECURITY SUPERVISOR APPLICATION

TO BE COMPLETED BY APPLICANT:

CONTRACTOR INFORMATION			
CONTRACTOR NAME		SUPERVISOR NAME	
BUSINESS ADDRESS (Number and Street)			
CITY		STATE	ZIP CODE (Last 4 digits are optional)
AREA CODE ()	PHONE NUMBER -		

EMPLOYEE INFORMATION				
EMPLOYEE NAME (Last)		(First)	(MI)	SUFFIX (JR., DR., II)
ADDRESS (Number and Street)			SOCIAL SECURITY NUMBER -	
CITY		STATE	ZIP CODE (Last 4 digits are optional)	
AREA CODE ()	PHONE NUMBER -		DATE OF BIRTH (MM/DD/YYYY)	
ARE YOU A U.S. CITIZEN? (IF NO, PROVIDE DOCUMENTATION AUTHORIZING YOU TO WORK IN THE U.S.)				
HAVE YOU EVER BEEN CONVICTED OF A FELONY? (IF YES, PLEASE EXPLAIN IN DETAIL)				

BY SIGNING BELOW, I CERTIFY THAT ALL INFORMATION PROVIDED IS TRUE AND CORRECT. PROVIDING FALSE STATEMENTS WILL BE GROUNDS FOR IMMEDIATE TERMINATION. I ALSO ACKNOWLEDGE THAT I MAY BE SUBJECT TO A BACKGROUND CHECK AND AUTHORIZE THE RELEASE OF INFORMATION FOR THAT PURPOSE.

SIGNATURE	DATE (MM/DD/YYYY)
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TO BE COMPLETED BY METRO-NORTH RAILROAD SECURITY DEPARTMENT:

<input type="checkbox"/> APPROVED	
<input type="checkbox"/> DENIED	
REASON	
SIGNATURE OF AUTHORIZED METRO-NORTH SECURITY DEPARTMENT REPRESENTATIVE	DATE (MM/DD/YYYY)
PRINTED NAME	TITLE

[illegible]

NOTICE TO CONTRACTOR – WORK ON RAILROAD PROPERTY

The Contractor acknowledges that work to be accomplished under this Contract is to be performed on Railroad territory, which consists of territory operated by Metro-North Railroad. The Contractor's work must be accomplished simultaneously with ongoing daily railroad operations. Such operations include, but are not limited to, the passage of trains, storage of trains, maintenance and repair of trains, flagging, inspection, repair, construction, reconstruction, and maintenance of the railroad right-of-way and facilities.

The Contractor is advised that the Railroad controls all activity in the right-of-way, and the Department expects that these conditions may cause delays and possibly a complete suspension of construction activity. If the Contractor is delayed or suspended in the completion of the work by railroad operations, the Contractor will be entitled to a time extension for every day that he can demonstrate that the delays affected the completion date of the Contract. This extension of time will be considered non-compensable and the Contractor will not be entitled to any additional compensation for damages incurred for all direct and indirect costs including, but not limited to, all delay and impact costs, and inefficiencies.

There is a need to coordinate demolition, construction work, track outages, material stockpiling and staging areas with the following nearby projects to the Noroton Heights Railroad Station:

- 0135-0301 Replacement of MNR Bridge over Atlantic St., Elm St., East Main St.
- 0300-0149 Positive Train Control (PTC)
- 0301-0047 Stamford Railroad Station Garage Demolition/Expansion
- 0301-0157 Real-Time Information Systems (Station & Platforms)
- 0301-0176 Walk Bridge Replacement Project

The Contractor's activities may overlap with activities of other contractors engaged in the execution of the above projects. There is a potential for limitations on track outages and extraordinary requirements for vehicular access coordination. The Contractor shall conduct his work within such limitations. This may require night work, premium time, weekend work, or multiple shifts. The Contractor is fully responsible to complete the contract work.

The Contractor shall be responsible for the coordination of the work of its various subcontractors. The Contractor shall coordinate its operations with those of the Railroad Company in carrying out railroad force account work.

The Contractor shall provide the Engineer with written notification a minimum of 14 days in advance of any work that requires a track or catenary outage or affects existing roadway circulation or parking areas within the Noroton Heights Railroad Station.

The Contractor's employees, and the employees of all subcontractors, who will be entering the jobsite within Railroad territory, must undergo an annual Railroad safety training class, of approximately one hour, offered by Metro-North Railroad. The Engineer will arrange for the

class; however, the Contractor is responsible for ensuring that all employees on the jobsite have been trained. No additional compensation will be allowed to the Contractor for employee's time for attending these classes. Refer to Form 816 Article 1.05.06.

The Contractor must make its own arrangements with the Railroad Company for the use of Railroad equipment or changes in Railroad facilities made solely to facilitate the Contractor's operations. The expense incurred by making such arrangements shall not be a part of this Contract.

The Contractor is hereby advised that Metro-North Railroad signal cable may exist within or adjacent to the project work area. The Contractor shall contact Mr. David Willard of Metro-North at (203) 337 3606, prior to any below ground excavation to assist in the identification and disposition of these cables. The signal cables are generally direct burial or in conduit, 18-72 inches below grade. Any cables or conduits which conflict with the contract work must be protected to the satisfaction of the Engineer or relocated by the Railroad prior to commencement of the work.

Contractor Requirements for Work Affecting the Railroad

The Contractor shall be governed by the General Requirements and Covenants of the Contract with the following additions:

1. All matters requiring Railroad Company approval or coordination shall be directed to:

Mr. David Willard
203-337-3606

2. In general, unless otherwise authorized by the Railroad, operations directly over or adjacent to the operating right-of-way will be performed during the following time periods:

<u>Outage</u>	<u>Time*</u>
Main line <u>SINGLE</u> track (Track 3) <u>OR</u> (Track 4) and catenary (including power)	Weekdays*: 12 AM to 5 AM
	Weekends*: 12 AM to 5 AM
Main line <u>SINGLE</u> track (Track 3) <u>OR</u> (Tracks 4) and catenary (including power)	A onetime 53-hour window during one weekend per stage (12 AM Saturday – 5 AM Monday)
Upon request at weekly MNR coordination meetings, and with the approval of MNR, adjacent (Track 1) <u>OR</u> (Track 2) outage may be granted (including power) during a <u>SINGLE</u> track outage, for construction activities that require it	Weekdays*: 12 AM to 5 AM
	Weekends*: 12 AM to 5 AM

***PLEASE NOTE:**

- Weekends are defined as: 12 AM Saturday to 11:59 PM Sunday
- Weekdays are defined as: 12 AM Monday to 11:59 PM Friday

3. The Contractor must submit a “work plan” to the Engineer for every track outage request. The work plan must include the reason for the outage along with the date and time, a safety assessment and identification of work hazards along with solutions to safety hazards, and a schedule of the Contractor’s work.

Notes:

1. Track outages will be considered as requests are submitted.
2. While every effort is made to accommodate the Project needs, track outages cannot be guaranteed at all times. Track outages are dependent on many circumstances; including weather, availability of protective personnel, conflicts with other projects and unforeseen operating problems. Therefore, no claims may be made against Metro-North for delays due to unavailability of track and/or power outages. Further, outages are granted on the basis of what is deemed necessary for construction, not merely for the Contractor’s convenience. Delays due to outage conflicts are subjected to “time only” delays.
3. The hours shown for track outages are not the actual time the tracks will be out of service. Time should be allowed for de-energizing and re-energizing power facilities.

4. Track outages requested and approved at the weekly railroad construction coordination meeting must be completed within the approved time frames. All personnel, materials, and equipment must be in the clear to allow for the safe use of the track by trains or railroad equipment by the end of the shift.
5. Unless otherwise arranged, the Contractor should expect to allow for his clearing of the track during the work shift in the event of a railroad operational emergency.
6. In the event of snow fall during the Contractor's work on a platform, the Contractor shall be responsible for removing the snow from the platform within the stage construction limits before returning the platform to service. The town shall be responsible for snow removal at all other locations of the station including any temporary structures.

Because the Contractor shall assume that the wires and rails of the Railroad will be energized at all times, the Contractor shall require all of its employees, subcontractors, and others, to sign a form similar to the following form, and furnish the Railroad with one original copy.

WARNING OF DANGER FROM ELECTRIFIED WIRES AND STRUCTURES
TO ALL PERSONS COMING NEAR ELECTRIFIED WIRES AND STRUCTURES

Notice is hereby given that contact, direct or indirect, with any of the electrified wires or structures of this Company is apt to result in serious injury or death and you are warned to avoid all such contact.

Dated

Job

AFE No.

Title

RECEIPT

I have this day received and carefully read the warning or danger from electrified wires and structures issued by you, which was attached to this receipt.

Signed _____

Occupation _____

Date _____

In the presence of

Witness _____

Job

AFE No.

NOTICE TO CONTRACTOR – CONSTRUCTION RESPONSIBILITY MATRIX

Activity	MNR Department	MNR Responsibilities	Contractor's Responsibilities
GENERAL			
Railroad Protection and Outages	Capital Projects	Provide flagmen for any work that fouls the track or has potential to foul the track including protection for hi-rail mounted equipment.	Coordinate with MNR when flagmen are needed
		Coordinate Contractor's need for track outages with operations.	Coordinate with MNR for track outages.
		Coordinate Contractor's need for power outages with Power Department.	
		Inspect Contractor's rail-mounted equipment for safety items and operations on track.	
		Provide safety training to Contractor's personnel.	
Railroad Work Coordination	Capital Projects	Coordinate removal and installation of existing station advertising signage with Outfront Media	Remove and reinstall all station signage
Power System Protect and Outages	Power	Provide A-men for any work that affects or potential to affect the Traction Power or Overhead Catenary System.	Coordinate with MNR when A-men are needed. Perform any work that affects traction power or Overhead Catenary System.
		De-energize catenary and feeder system as required for work within 10' of wires	

Activity	MNR Department	MNR Responsibilities	Contractor's Responsibilities
Final Inspection	Capital Projects	Inspect railroad related work performed by contractor once work is substantially complete.	
PLATFORM REMOVAL/REPLACEMENT, ACCESS STRUCTURE REMOVAL/REPLACEMENT			
Structural, Architectural, Civil	Structural		Install temporary fencing, platform barricades and sediment control system
		Relocate Bridge Plates and bases at Noroton Heights Station during stage construction	
		Install Bridge Plates, bases and car markers at Noroton Heights, Rowayton and Dairen stations for track outages	
			Install Temporary Precast Concrete Barrier Curb (TPCBC)
			Install temporary support system of Hollow Tree Ridge Rd stairway
		Verify installation procedure and limits	Install protection system for ballast and tracks
		Dispose of removed recycling centers (removed by contractor)	Remove existing guardrails, handrails, benches, light poles VMS/PA system and recycling centers from the existing platforms, provide MNR removed recycling centers, store VMS panels
			Remove existing platform sections and access structures
			Assemble/erect platform sections
			Form and pour concrete overlay
			Apply railroad platform waterproofing

Activity	MNR Department	MNR Responsibilities	Contractor's Responsibilities
		Apply "Watch the Gap" to platforms	
			Assemble/form/erect access structures and substructures
			Install/erect temporary shelter
			Install/erect permanent shelter
		Install new recycling centers provided by Contractor	Install platform appurtenances (Handrail/Guardrail, benches, light poles, etc.) acquire new recycling centers
		Remove bridge plates and bases	
			Install concrete sidewalk
			Remove Barrier Temporary Precast Concrete Barrier Curb
Electrical	Power		Restore existing pavement and grass areas disturbed by construction
			Run electric conduit throughout platforms, acquire all power wire
			Relocate electrical panel located in the eastbound platform shelter
			Pull power wires through conduit on platform, catenary and pedestrian overpass for VMS/PA system and platform lighting
			Perform LED modifications to existing platform light poles and canopy lighting
			Purchase speakers for PA system.
		Oversee and inspect installation of system, tie-in to the catenary	Install grounding connections throughout station

Activity	MNR Department	MNR Responsibilities	Contractor's Responsibilities
		structures	Install grounding and bonding on platforms and all necessary appurtenances (guardrail/handrail, benches, recycling centers, etc), make temporary connection to previously installed grounding system during stage construction
			Perform final connections of complete station grounding and bonding system throughout entire station except final connections to existing catenary structures
		Witness final testing of grounding and bonding	Perform final testing of Grounding and Bonding
Communications Systems	Communications	Perform disconnect of power and communication wires to PA system	
		Perform disconnect of power and communications wires to VMS system	
			Run communication conduit throughout platforms, acquire all communication wire
			Pull communication wires through conduit installed on platform, catenary and pedestrian overpass for VMS/PA system and platform lighting
		Final tie-in of power and communication wires to PA system and VMS system	
		Final tie-in of power and communication wires for VMS/PA system to existing panel	

Activity	MNR Department	MNR Responsibilities	Contractor's Responsibilities
		Perform final testing of VMS and PA system	
TVM RELOCATION			
Structural, Architectural, Civil	IT	Relocate TVMs to temporary location, anchor to slab	
		Move TVMs back to permanent platform location	
	Structural		Acquire conduits for temporary proposed power and communication conduit runs, with necessary wires.
			Install concrete slab
			Install/erect shelter for TVMs
			Remove shelter and anchorage
Electrical	Power	Run temporary conduits for power to temporary location of TVMs	
		Pull power wires through installed temporary conduit	
		Removed temporary conduit for power and wires.	
Communications Systems	Communications	Run temporary conduits for communication to temporary location of TVMs	
		Pull communication wires through installed temporary conduit	
		Remove temporary conduit for	

Activity	MNR Department	MNR Responsibilities	Contractor's Responsibilities
		communication and wires	
Electrical	Power/C&S	Perform connection to TVMs at temporary location and tie-in to existing panel	
		Disconnect temporary power and communication wires from TVMs in temporary location	
		Reconnect TVMs to existing power and communication lines on platform.	
MNR HARDLINE PLATFORM TELEPHONES			
Structural, Architectural, Civil	Structural		Place additional conduit to end of platforms for MNR phones
			Coordinate placement of telephone pole on platform with MNR, perform drilling through platform for conduit.
Communications Systems	Communications	Acquire telephones with all necessary equipment	
		Install telephones and poles	
		Pull communication wires through placed conduit	
		Perform test of system	

NOTICE TO CONTRACTOR – ROADWAY ACCESS WITHIN NOROTON HEIGHTS RAILROAD STATION

The Contractor is hereby advised that maintaining access to all existing railroad tracks, equipment, facilities, and construction sites within the Noroton Heights Railroad Station for railroad and State employees, contractors, emergency vehicles and others is hereby required. Access through the Project area shall be maintained at all times from the public entrances along Heights Rd, Hollow Tree Ridge Rd and Ledge Rd.

Temporary roadways in the Project area shall be surfaced with processed aggregate base sufficient to provide a stable driving surface. No stone ballast or miscellaneous fills shall be used to surface temporary roadways. The Contractor shall be responsible for maintaining temporary roadways in the Project area, including the filling of potholes, re-grading, snow removal and all other maintenance work required to maintain a driving surface suitable for the passage of a typical passenger vehicle. Construction and maintenance of temporary roadways shall be provided at no additional cost to the Department.

The Contractor shall repair any and all damage to the existing station roadway network and associated appurtenances located within and outside of the Project area which result from the Contractor's operations. Repairs shall be made within 24 hours of the occurrence of the damage or as directed by the Engineer. Repairs shall restore roadways to the line and grade existing at the time the Contract was awarded. Construction methods and materials shall be of like kind and quality to that used in the original construction of the roadway network. The Contractor shall make all repairs at no additional cost to the Department.

No existing or temporary roadways shall be reduced in width, relocated, or shut down without first submitting a traffic plan to the Engineer for approval. Also see **NOTICE TO CONTRACTOR – WORK ON RAILROAD PROPERTY**.

The Contractor shall bid the Contract accordingly.

NOTICE TO CONTRACTOR – METRO-NORTH RAILROAD FORCE ACCOUNT WORK AND COORDINATION

The Contractor is hereby notified that the following represents, in general, construction services and material to be furnished and completed by Metro-North Railroad (MNR). Refer to NOTICE TO CONTRACTOR - CONSTRUCTION RESPONSIBILITY MATRIX for a detailed listing.

1. Remove or relocate MNR owned materials and equipment, stored on the construction site, if it is in conflict with the Contractor's activities.
2. Provide flagmen as required during construction.
3. Provide work train and crew for Metro-North construction services, as required.
4. Provide Class A personnel protection, as required.
5. Make all "hot connections" to in-service railroad systems, as required.

The above list may not be all-inclusive and does not relieve the Contractor from its responsibility to coordinate work with MNR that is required under other Contract provisions.

Work performed by MNR will directly affect the Contractor's operation. Special coordination efforts by the Contractor will be required in support of MNR force account work which may be executed in multiple stages at various times and locations throughout the duration of the Project.

The Contractor shall provide MNR access to the Project site required for MNR to complete its work.

NOTICE TO CONTRACTOR – ELECTRICAL POWER TO SITE

The Contractor is hereby advised that temporary electrical power is not readily available to this Project and the use of portable generators may be required. The Contractor is advised that it may be necessary to coordinate the installation of electrical power, including temporary power, to the site early in the construction process. The station electrical distribution system is owned by the Department and operated by Metro-North Railroad. The Contractor shall coordinate this activity with the Engineer and Metro-North Railroad for work depicted on the Contract Documents. The Contractor shall bid the Project accordingly.

NOTICE TO CONTRACTOR – ELECTRIC POWER

The Contractor is hereby notified that all temporary electrical power installations must be grounded per the latest adopted National Electric Code.

Additionally, all equipment shall be grounded to a common ground.

NOTICE TO CONTRACTOR – COMMON WORK RESULTS FOR ELECTRICAL

The Contractor is hereby advised that he shall perform the electrical equipment coordination and common electrical installation requirements such as sleeves for raceways and cables, sleeve seals, and grout. All work shall be in strict conformance with the latest National Electric Code. All electrical components shall be installed per requirements of NFPA 70, NFPA 70E and other codes identified in the Contract Documents.

Description:

This specification covers all proposed electrical work as shown on the Contract Plans.

Materials:

All steel pipe sleeves shall be ASTM A53/A53M, Type E, Grade B, Schedule 80, galvanized steel, plain ends. All Sleeve Seals shall be Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable. Grout: Nonmetallic, Shrinkage-Resistance Grout, ASTM C1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, mixed with water to consistency suitable for application and 30-minute working time.

The Contractor must submit samples of any product used in the construction, if directed by the Engineer. Any opening in the fire rated walls due to the penetration of conduit shall be sealed with a 1 HR rated sealant. The Contractor shall submit product data and assurance submittals in accordance with NOTICE TO CONTRACTOR – POTENTIAL FOR ASBESTOS CONTAINING MATERIALS. Refer to Form 816 Article 1.06.03 and Form 816 Article 1.20-1.06.03 for additional information, for delivery, storage and handling.

Method of Measurement:

No separate measurement will be made for the work in this Section. All costs in connection therewith will be considered as follows:

- ITEM #0063521A – RAIL FACILITY UPGRADE (SITE NO. 1)
- ITEM #1003925A – REMOVE EXISTING LUMINAIRE
- ITEM #1003926A - REINSTALL LIGHT POLE
- ITEM #1003997A – REMOVE POLE
- ITEM #1005600A – LED LUMINAIRE
- ITEM #1008183A – 3/4" PVC COATED CONDUIT
 - ITEM #1008184A – 1" PVC COATED CONDUIT
 - ITEM #1008186A – 4" PVC COATED CONDUIT
- ITEM #1008901A – REMOVE CONDUIT

Basis of Payment:

The work required to be done in accordance with these specifications, will not be paid for separately but will be considered incidental to the following:

- ITEM #0063521A – RAIL FACILITY UPGRADE (SITE NO. 1)
- ITEM #1003925A – REMOVE EXISTING LUMINAIRE
- ITEM #1003926A - REINSTALL LIGHT POLE
- ITEM #1003997A – REMOVE POLE
- ITEM #1005600A – LED LUMINAIRE
- ITEM #1008183A – 3/4" PVC COATED CONDUIT
 - ITEM #1008184A – 1" PVC COATED CONDUIT
 - ITEM #1008186A – 4" PVC COATED CONDUIT
- ITEM #1008901A – REMOVE CONDUIT

NOTICE TO CONTRACTOR – UNDERGROUND UTILITIES

The work to be accomplished under this Contract is to be performed within the Noroton Heights Railroad Station. Contractor must coordinate with Call-Before-You-Dig (CBYD) for the mark out of any underground utilities within the Project limits. The Contractor is responsible for locating all utilities in locations not coordinated by CBYD, prior to performing any excavations.

Refer to NOTICE TO CONTRACTOR – PROTECTION OF EXISTING UTILITIES for additional information.

NOTICE TO CONTRACTOR – PROTECTION OF EXISTING UTILITIES

The utilities within the limits of the station are shown on the contract plans. The Contractor shall be aware that before, during, and after the completion of the project, there are several other ongoing independent projects adjacent to the project limits. These projects are as listed in NOTICE TO CONTRACTOR - WORK ON RAILROAD PROPERTY. These projects may include the relocation of existing utilities and the installation of new facilities. It should be noted that the Contractor's activities may overlap the activities of the contractors engaged in the execution of the other projects, as well as the activities of State of Connecticut, Metro-North Railroad, Amtrak, and other railroad and utility company personnel.

The Contractor shall completely coordinate his operations with the affected utility companies and/or agencies, and ensure that his work is coordinated with that of the other contractors. The coordination of the work is the complete responsibility of the Contractor. When the work required under his contract is in conflict with work being carried out by another contractor or agency, it is the responsibility of the Contractor to notify the Engineer immediately of the conflict.

Existing utilities shall be maintained during construction except as specifically stated herein and/or noted on the Construction Documents and as coordinated with the utilities. The Contractor shall verify the location of underground, structure mounted and overhead utilities. Construction work within the vicinity of utilities shall be performed in accordance with current safety regulations.

The Contractor shall notify “Call Before You Dig”, telephone 1-800-922-4455 for the location of public utility, in accordance with Section 16-345 of the Regulations of the Department of Utility Control. Refer to NOTICE TO CONTRACTOR – UNDERGROUND UTILITIES for additional information.

Representatives of the various utility companies shall be provided access to the work by the Contractor.

Contractors are cautioned that it is their responsibility to verify locations, conditions, and field dimensions of all existing features, as actual conditions may differ from the information shown on the Contract Documents or contained elsewhere in the specifications. Verifications may require the excavation of exploratory test pits.

The Contractor shall notify the Engineer prior to the start of work and shall be responsible for all coordination with the Department. The Contractor shall allow the Engineer complete access to the work.

The Contractor shall be liable for all damages or claims received or sustained by any persons, corporations or property in consequence of damage to the existing utilities, their appurtenances, or other facilities caused directly or indirectly by the operations of the Contractor.

Any damage to any existing private or public utility, as a result of the Contractor's operations, shall be repaired to the Utility's and the Engineer's satisfaction at no cost to the State or the Utility, including all materials, labor, etc., required to complete the repairs.

The Contractor's attention is directed to the requirements of Section 1.07.13 – "Contractor's Responsibilities for Adjacent Property, Facilities and Services".

Prior to opening an excavation, effort shall be made to determine whether underground installations, i.e., water, sanitary, gas, electric ducts, communication ducts, etc., will be encountered and, if so, where such underground installations are located. Also see the special provision/item "Non-Destructive Utility Investigation". When the excavation approaches the estimated location of such an installation, the exact location shall be determined by careful probing or hand digging, and when it is uncovered, proper supports shall be provided for the existing installation. Utility companies shall be contacted and advised of proposed work prior to the start of actual excavation, as noted above.

NOTICE TO CONTRACTOR – USE OF STATE PROPERTY

Use of State property by the Contractor for purposes other than the construction activities included in this Contract requires advance approval from the Engineer.

This applies to activities including, but not limited to: Staging and storage areas, screening/crushing operations, asphalt or concrete plants, gravel/borrow pits, and other manufacturing and/or mining operations.

The bulk storage of fuels and lubricants shall not be permitted on State property.

The storage of hazardous materials, other than those associated with the Contractor's Project related operations, shall not be permitted on State property. The Contractor shall assume sole responsibility for the proper storage, handling, management, and disposal of hazardous materials. All remedial and punitive costs incurred by the Department as a result of the Contractor's failure to properly manage hazardous materials shall be borne by the Contractor.

The Contractor is cautioned that environmental testing of the site may be required at the Contractor's expense both prior to and upon completion of the use of the State property. The Contractor shall be responsible for restoring the site and removal of all contaminants which may have been deposited at the site during its use. The Contractor must conform to the Department's Best Management Practices, environmental permit conditions and other applicable State and federal regulations. The use and restoration of the site will be at no cost to the State of Connecticut. The use of the site will be for this specific DOT Project only. In addition, approval or denial of such request shall not be used as a reason for any time extensions or claim.

For Staging and Storage Areas

The Contractor must submit all requests for the temporary use of any State property in writing to the Engineer. The following minimum information shall be included with the request(s): a description of the proposed operation or use of the site; a site plan detailing the location of the proposed operation/use, and sedimentation and erosion controls; an area plan detailing ingress and egress to the site and proximity to residential and/or occupied buildings; copies of any required environmental permits; and planned hours of operation. The submittal shall also include photo documentation (minimum of 12 each, 8"x10" color photos) showing the preconstruction condition of the site and adjacent property at the site boundaries. If the site is State property outside of the DOT right of way, authorization from other State Agencies will also be required for use of the property or site.

For Use Other than Construction Staging and Storage Areas

The Contractor must submit all requests for the temporary use of any State property in writing to the Engineer. The request(s) shall include the same information required for storage and staging areas. In addition, the Contractor will be required to provide written confirmation that the municipality in which the site is located does not object to the proposed use of the State property. The Contractor will be required to execute a license agreement with the Department for use of State property for other than staging and storage areas.

For asphalt batching or continuous mix facilities, the Contractor shall also provide a map detailing the outer most perimeter of the facility showing all structures, land use, watercourses, wetlands, and areas of environmental concern with one-third mile of the facility perimeter. No such facility will be permitted on State property where any hospital, nursing home, school, area of critical environmental concern, watercourses, or residential housing exists within one-third mile of the perimeter of the facility (P.A. 98-216).

NOTICE TO CONTRACTOR – CONTRACT DURATION

The Contractor is hereby notified that this is not to be considered an ordinary project by any means and that due to the inconvenience to the traveling public that it causes, extra manpower, equipment and workshifts may be required to complete the work in accordance within the specified contract time.

NOTICE TO CONTRACTOR – CAS CERTIFICATION FOR ABRASIVE BLAST CLEANING AND COATING WORK

This Contract requires abrasive blast cleaning and coating work be done with at least one (1) Coating Application Specialist per four (4) craft-workers. Coating Application Specialist (CAS) certification is available through the Society for Protective Coatings (SSPC). The CAS program is based on the requirements of SSPC ACS-1/NACE 13, a standard published jointly in 2008 by SSPC and NACE International (National Association of Corrosion Engineers). ACS-1 defines training and experience requirements that tradespersons must have in order to qualify to be assessed for certification. CAS QP-1 implementation requires that the CAS Level II certified applicator be on the job during abrasive blast cleaning and painting operations.

The firm proposed to perform abrasive field blast cleaning and coating on this Project must meet the requirements outlined in the special provisions under “Contractor - Subcontractor Qualifications.”

When applicable, the shop painting firm proposed to perform abrasive blast cleaning and shop painting on this Project must meet the requirements outlined in the special provisions under “Qualifications of Shop Painting Firm.”

NOTICE TO CONTRACTOR – SUBMITTALS AND PROCUREMENT OF MATERIALS

Upon award, the Contractor shall proceed with shop drawings, working drawings, procurement of materials, and all other submittals required to complete the work in accordance with the contract documents. The Contractor may not begin any field work until authorized by the Engineer in accordance with ARTICLE 1.03.08 – NOTICE TO PROCEED AND COMMENCEMENT OF WORK.

NOTICE TO CONTRACTOR – RAILROAD SPECIFICATIONS

The contractor is hereby notified that all railroad specifications contained elsewhere herein shall be made a part of this contract, and that the contractor shall be bound to comply with all requirements of such specifications. The requirements and conditions set forth in the subject specifications shall be binding on the contractor just as any other specification would be.

NOTICE TO CONTRACTOR – UTILITY SPECIFICATIONS

The contractor is hereby notified that all utility specifications contained elsewhere herein shall be made a part of this contract, and that the contractor shall be bound to comply with all requirements of such specifications. The requirements and conditions set forth in the subject specifications shall be binding on the contractor just as any other specification would be.

NOTICE TO CONTRACTOR – HAZARDOUS MATERIALS INVESTIGATIONS

Hazardous building materials site investigations have been conducted at the Noroton Heights Railroad Station in Darien, Connecticut where platforms are scheduled to be replaced.

The results of these investigations indicated the presence of asbestos containing materials (ACM), lead based paint (LBP) and additional hazardous or otherwise regulated items (within the proposed construction areas). However, ACM in the form of transite was only found on the advertisement billboards and they are reportedly to be removed by Metro North Railroad (MNRR).

The Contractor is hereby notified that these hazardous building materials requiring special management or disposal procedures will be encountered during various construction activities conducted within the project limits. The Contractor will be required to implement appropriate health and safety measures for all construction activities impacting these materials. These measures shall include, but are not limited to, air monitoring, engineering controls, personal protective equipment and decontamination, equipment decontamination and personnel training. **WORKER HEALTH AND SAFETY PROTOCOLS WHICH ADDRESS POTENTIAL AND/OR ACTUAL RISK OF EXPOSURE TO SITE SPECIFIC HAZARDS ARE SOLELY THE RESPONSIBILITY OF THE CONTRACTOR.**

The Department, as Generator, will provide an authorized representative to sign all manifests and waste profile documentation required by disposal facilities for disposal of hazardous materials.

The Sections which shall be reviewed by the Contractor include, but are not limited to, the following:

- Item No. 0020902A – Lead Compliance for Building Renovation and Demolition
- Item No. 0101143A – Handling and Disposal of Regulated Items (Estimated Cost)

The Contractor is alerted to the fact that a Department environmental consultant will be on site for abatement and related activities, to collect environmental samples (if necessary), and to observe site conditions for the State.

Information pertaining to the results of the hazardous building materials investigation discussed can be found in the documents listed below. These documents shall be available for review at the Office of Contracts, 2800 Berlin Turnpike, Newington, Connecticut.

- Pre-Renovation Investigative Survey for Hazardous Building Materials, Noroton Heights Railroad Station – Platform Replacements, Darien, Connecticut. TRC Environmental Corporation, January 2016.

NOTICE TO CONTRACTOR – SECTION 4.06 AND M.04 MIX DESIGNATION EQUIVALENCY AND PG BINDER EQUIVALENCY

Sections 4.06 and M.04 have been replaced in their entirety with the Special Provisions included as part of this contract. These Special Provisions reflect changes in mix designations for various types of hot-mix asphalt (HMA) and include the removal of mixes designed and governed by the Marshall Mix Design method. The following table is to be used to associate mix designations noted on the plans with those in the contract specifications and related documents. Mix designations on each row are equivalent and refer to a single mix, which shall be subject to the requirements of the Section 4.06 and M.04 Special Provisions for the Official Mix Designation in the leftmost column of the corresponding row in the table.

Mix Designation Equivalency Table

Official Mix Designation	Equivalent Mix Designation (a)	Equivalent Mix Designation (b)
(c)	Superpave 1.5 inch	Superpave 37.5 mm
HMA S1	Superpave 1.0 inch	Superpave 25.0 mm
HMA S0.5	Superpave 0.5 inch	Superpave 12.5 mm
HMA S0.375	Superpave 0.375 inch	Superpave 9.5 mm
HMA S0.25	Superpave 0.25 inch	Superpave 6.25 mm
(c)	Superpave #4	Superpave #4
HMA S0.5 (d)	Bituminous Concrete Class 1 (e)	Bituminous Concrete Class 1 (e)
HMA S0.375 (d)	Bituminous Concrete Class 2 where it is specified in lifts 1.25 or thicker (e)	Bituminous Concrete Class 2 where it is specified in lifts 1.25 or thicker (e)
HMA S0.25 (d)	Bituminous Concrete Class 2 where it is specified in lifts 1.0 inches to less than 1.25 inches (e); Bituminous Concrete Class 12 (e)	Bituminous Concrete Class 2 where it is specified in lifts 1.0 inches to less than 1.25 inches (e); Bituminous Concrete Class 12 (e)
HMA S1 (d)	Bituminous Concrete Class 4 (e)	Bituminous Concrete Class 4 (e)
Curb Mix	Bituminous Concrete Class 3	Bituminous Concrete Class 3

Notes

(a) This mix designation is generally included with projects where the English measurement system is used. The mix designation may contain both the English measurement system

designation and the SI (metric) measurement system designation, one of which would be in parenthesis.

(b) This mix designation is generally included with projects where the SI (metric) measurement system is used. The mix designation may contain both the English measurement system designation and the SI measurement system designation, one of which would be in parenthesis.

(c) This mix is no longer in use except by contract-specific Special Provision; if this mix is called for in the Plans but no such Special Provision is included for this contract a suitable substitute must be approved by the Engineer.

(d) Unless approved by the Engineer, the Superpave Design Level for the Official Mix Designation bituminous concrete replacing a Marshall mix called for in the plans or other contract documents shall be Design Level 2 for mixes used on mainline or shoulders of state-maintained roadways and Design Level 1 elsewhere, including but not limited to driveways or sidewalks.

(e) All mixes designed under the Marshall mix-design method are no longer covered by the 4.06 Special Provision. Wherever they appear in Contract plans and documents they shall be substituted by the “Official Mix Designation” in the same row of the Mix Designation Equivalency Table. Unless approved by the Engineer, the Superpave Design Level shall be Level 1.

PG Binder Designation Equivalency Table

Official Binder Designation	Equivalent Binder Designation	Use
PG 64S-22	PG 64-22	Hot-Mix Asphalt (HMA S* pay items and pay items using HMA S* materials)(a),(b)
PG 64E-22	PG 76-22	Polymer-Modified Asphalt (PMA S* pay items and pay items using HMA S* materials)(a),(b)

Notes

(a) Use the Mix Designation Equivalency Table above to identify the Official Mix Designation for materials using the Marshall mix design method, i.e. “Bituminous Concrete Class *.”

(b) Refer to the NTC – Superpave Design Level for the Superpave Design Level to use for each mix on a project. The PG Binder Designation Equivalency Table can be used to obtain the Official Binder Designation for each mix identified in the NTC – Superpave Design Level.

NOTICE TO CONTRACTOR – SUPERPAVE DESIGN LEVEL INFORMATION

Hot-Mix Asphalt (HMA) and Polymer-Modified Asphalt (PMA) constructed according to the Superpave mix-design system are required to attain a Superpave Design Level and are required to use a Performance Graded (PG) binder. The Superpave Design Levels required for this project are listed in Table 1. The required PG binder is indicated for each mix with an “X” in the appropriate box in Table 1.

TABLE 1 – Superpave Design Level and Performance Graded (PG) Binder

Mix Designation	PG Binder		Project Wide
	PG 64S-22	PG 64E-22	Design Level
HMA S0.25	-	-	-
HMA S0.375	X	-	2
HMA S0.5	-	-	-
HMA S1	-	-	-
PMA S0.25	-	-	-
PMA S0.375	-	-	-
PMA S0.5	-	-	-
PMA S1	-	-	-

Note: Please note that PMA mix designations typically use PG 64E-22 and HMA mix designations use PG 64S-22

SECTION 1.01 – DEFINITION OF TERMS AND PERMISSIBLE ABBREVIATIONS

1.01.01--Definitions:

Delete the following term:

“SHOP DRAWINGS: Drawings, including . . . in the Contract.”

Replace paragraph “C. Special Provisions” under “SPECIFICATIONS” with the following:

C. Special Provisions—Other Department specifications applicable to an individual project, including NOTICE TO CONTRACTORS.

SECTION 1.02 – PROPOSAL REQUIREMENTS AND CONDITIONS

Article 1.02.04 – Examination of Plans, Specifications, Special Provisions and Site Work:

Replace the third sentence of the last paragraph with: The Department cannot ensure a response to enquiries received later than ten (10) days prior to the original scheduled opening of the related bid.

SECTION 1.05 – CONTROL OF THE WORK

1.05.02--Plans, Working Drawings, and Shop Drawings:

Delete the entire subsection entitled "3. Shop Drawings:"

1.05.06--Cooperation With Utilities (including Railroads):

Add the following after the last paragraph:

“Special Requirements Regarding Work in Metro-North territory:

Description:

This section covers authority, definitions, regulatory requirements, traffic regulation and coordination of the Contractor's work schedule with the operation of train service, construction equipment and safety requirements for working within railroad right-of-way, and provisions for storage of materials and equipment and worker safety rules. Subsequent to the Engineer's Pre-Construction Meeting and prior to commencement to Contract activities, the Engineer will hold a Working on the Railroad Meeting to emphasis these Specifications.

Metro-North Commuter Railroad Company – Permission to Enter Upon Railroad Property

Permission is hereby granted to the Contractor to enter property of the State of Connecticut, under the custody and control of the Connecticut Department of Transportation (hereinafter called "ConnDOT") and managed by Metro-North Commuter Railroad Company (hereinafter called "Railroad"), a public benefit corporation and subsidiary of Metropolitan Transportation Authority (hereinafter called "MTA"). The purpose of this permission shall be solely for the purposes outlined in this Contract and under the following terms and conditions:

1. Location and Access. Permission is hereby granted to the Contractor and its subcontractor(s), if any, to enter the property within the Project Limits identified on the Contract Plans (hereinafter called the "Property").
2. Liability. The Contractor covenants and agrees to at all times indemnify, protect and save harmless MTA, Railroad, National Railroad Passenger Corporation ("AMTRAK"), Housatonic Railroad Company ("Housatonic"), Providence & Worcester Railroad Company ("P&W"), and ConnDOT from and against any and all losses, damages, detriments, suits, claims, demands, costs, and charges which MTA, Railroad, AMTRAK, Housatonic, P&W, or ConnDOT may directly or indirectly suffer, sustain, or be subjected to by or on account of Contractors entry upon, occupancy or use of the Property, or the conduct thereon of the Contractor, its subcontractors, officers, employees, agents or invitees, whether such loss or damage be suffered or sustained by MTA, Railroad, AMTRAK, Housatonic, P&W or ConnDOT directly or persons (including employees of MTA, Railroad or ConnDOT or Corporations who may seek to hold MTA, Railroad, AMTRAK, Housatonic, P&W or ConnDOT liable therefor), and whether attributable to the

fault, failure or negligence of MTA, Railroad, AMTRAK, Housatonic, P&W or ConnDOT or otherwise.

3. Consideration. The Contractor will pay to the Railroad, the sum of Zero Dollars (\$0.00) for the right to enter upon the Property.
4. Terms of Permit. The Railroad reserves the right to revoke this permission at any time. Unless subsequently modified, this shall begin with notice to proceed and shall end at Contract completion at which time it shall expire automatically. Under no circumstances shall this temporary permission be construed as granting the Contractor any rights, title or interest of any kind or character in, on, or about the land or premises of MTA or Railroad thereafter. The Permittee agrees to notify the Railroad when use of the Property or work is completed.

DEFINITIONS:

Railroad - Whenever the term "Railroad" is used without further qualification, it shall be taken to mean Metro-North Railroad.

On or Adjacent to - shall be interpreted to include space on, above and below railroad right-of-way operated by Metro-North, as well as space on, above, and below adjacent property which Metro-North determines to affect the safe operations of railroad service.

The Safety Rules - All work shall be performed in accordance with rules, regulations, procedures, and safe practices on the Railroad, FRA, OSHA, NESC and all other government agencies having jurisdiction over this Project.

Authority of the Engineer - This supplements Article 1.05.01 in that all Contract work upon or affecting railroad property, right-of-way or facilities, shall also be subject to the approval of the Chief Engineer, Maintenance of Way of the Railroad or its duly authorized representative, through coordination with the Engineer.

Coordination of Work - The Contractor shall be responsible for the coordination of the work of its subcontractors with respect to the railroad property, right-of-way or facilities.

Track - The space between the rails plus not less than 4-ft outside each rail.

Horizontal Clearance Point - A point 10-ft from the centerline of a track.

Vertical Clearance Point - A point 22'-6" above the top of a running rail unless otherwise authorized by Metro-North.

Traffic Envelope - The area encompassed by the vertical and the horizontal clearance points.

Obstruction - An entering of the traffic envelope, also referred to as fouling.

Occupancy - Any use of track other than direct crossing.

Right-of-Way - The limits of railroad property on either side of tracks.

Use of Track - Obtaining permission from the proper authority at Metro-North for track occupancy.

Conductor/Flagman - A Metro-North employee qualified on the Rules of the Operating Department and qualified on the physical characteristics of the portion of the railroad involved. They are the contact employee qualified to obtain the use of track. Each conductor/flagman will have the proper flagging equipment, up-to-date Metro-North Operating Rules, Metro-North Timetables and Metro-North Safety Rules.

Groundman - Class "A" employee of Metro-North's Power Department authorized to de-energize/re-energize and ground high-tension power lines.

Qualified Metro-North Employee - For the purpose of these instructions, a qualified employee is a Metro-North employee qualified to remove track or tracks from service.

1.0 REQUIREMENTS FOR PERFORMING WORK ON OR ADJACENT TO THE RIGHT OF WAY OF THE RAILROAD

1.1 General

- 1.1.1 The Contractor should note that the proposed work involves construction operations on or adjacent to property owned by ConnDOT and operated by Metro-North Railroad. In working near an operating Railroad, great care must be exercised and the Railroad's safety rules must be strictly observed.
- 1.1.2 If while completing the work covered by this Contract, the tracks or other facilities of the Railroad are endangered, the Contractor shall immediately do such work as directed by the Railroad through the Engineer to restore safety. Upon failure of the Contractor to carry out such orders immediately, the Railroad may take whatever steps as are necessary to restore safe conditions. The cost and expense to the Railroad of restoring safe conditions, or of any damage to the Railroad's trains, tracks or other facilities caused by the Contractor's or subcontractor's operations, shall be considered a charge against the Contractor and shall be paid for by him, or may be deducted from any monies due or that may become due him under this Contract.

1.2 Rules and Regulations

- 1.2.1 Railroad traffic shall be maintained at all times, and the Contractor shall conduct all of its operations on or adjacent to the Railroad right-of-way fully within the rules, regulations, and requirements of the Railroad. The Contractor shall be responsible for acquainting himself with such requirements as the Railroad may demand. The Contractor shall include in its bid any expenses occasioned by delay or interruption of its work by reason of the operation or maintenance of the Railroad facilities.
- 1.2.2 The Contractor shall obtain verification of the time and schedule of track occupancy from the Railroad before proceeding with any construction or demolition work on or adjacent to the Railroad right-of-way.
- 1.2.3 All work to be done on or adjacent to the Railroad right-of-way shall be performed by the Contractor in a manner satisfactory to the Railroad and shall be performed at such times and in such manner as not to interfere with the movement of trains or traffic upon the tracks of the Railroad. The Contractor shall use all necessary care to avoid accidents, damage, delay or interference with the Railroad's trains or property.

- 1.2.4 If deemed necessary by the Railroad, it may furnish or assign an inspector who will be placed on the work during the time the Contractor or any subcontractor is performing work under the Contract on Railroad property.
- 1.2.5 Before proceeding with any construction of demolition work on or adjacent to the Railroad's property, a pre-construction meeting shall be held at which time the Contractor shall submit for approval of the Railroad, Plans, computations, and a detailed description of its method of procedure for accomplishing the specific construction work required under this Contract, including methods of protecting Railroad traffic. Such approval shall not serve in any way to relieve the Contractor of its complete responsibility for the adequacy and safety of its methods of procedures.
- 1.2.6 The Contractor shall conduct its work and handle its equipment and materials so that no part of any equipment shall foul an operated track or wire line without the written permission of the Railroad.
- 1.2.7 Equipment shall be considered to be potentially fouling the track when located in such a position that failure of same with or without load brings the equipment within the traffic envelope. No equipment shall be placed in this position without prior approval of the Railroad.
- 1.2.8 Equipment of the Contractor to be used:
 - 1.2.8.1 Equipment of the Contractor to be used adjacent to the tracks shall be in first-class condition so as to fully prevent failures of defective equipment that might cause delay in the operations of trains or damage to Railroad facilities. Its equipment shall not be placed or put into operation adjacent to tracks without first obtaining permission from the Railroad. Under no circumstances shall any equipment or materials be placed or stored within 25-ft from the near rail of a track in operation, unless approved in advance by the Metro-North representative.
 - 1.2.8.2 High rail equipment of the Contractor to be used on the tracks shall be subject to prior approval of the Railroad. The equipment must be inspected and approved in advance at Metro-North's facility by Metro-North inspectors.
 - 1.2.8.3 On track vehicles shall be equipped with a MNR approved tow bar and coupler. Multiple vehicles shall move in tandem and coupled when directed by Metro-North. Movement of on track vehicles shall proceed only under the direct supervision of a qualified MNR employee.
- 1.2.9 Materials and equipment belonging to the Contractor shall not be stored on Railroad property without first having obtained permission

from the Engineer and Railroad, and such permission will be on the condition that the Engineer and Railroad will not be liable for damage to such materials and equipment from any cause. The Contractor shall keep the tracks adjacent to the site clear of all refuse and debris that may accumulate from its operations and shall leave the Railroad property in the condition existing before the start of its operations.

- 1.2.10 The Contractor shall coordinate with the Engineer and the Railroad in order to determine the type of protection required to insure safety and continuity of Railroad traffic incident to the particular methods of operation and equipment to be used on the work.
 - 1.2.11 The Railroad will require protection during all periods when the Contractor is working on, or over, the right-of-way of the Railroad, or as may be found necessary in the opinion of the Railroad. When protection is required, refer to Paragraph 1.7.
 - 1.2.12 It shall be expressly understood that this Contract includes no work for which the Railroad is to be billed by the Contractor, and it shall be further understood that the Contractor is not to bill the Railroad for any work which he may perform, unless the Railroad gives a written request that such work be performed at its expense.
 - 1.2.13 Upon completion of the work, and before final payment is made, the Contractor shall remove from within the limits of the Railroad's right-of-way, all machinery, equipment, surplus materials, falsework, rubbish and temporary buildings, and other property of the Contractor/sub-contractor, and shall leave the right-of-way in a condition satisfactory to the Railroad.
- 1.3 Railroad Protective Services: Railroad protective services will be provided in accordance with the Roadway Worker's Protective Act, Title 49, Part 214, Sub-part C. Railroad protective services will also be performed to insure safe operations of trains when construction work would, in the Railroad's opinion, be a hazard to Railroad operations.
 - 1.4 Definition of Hazard: Metro-North has furnished the statements quoted below explaining when they consider a hazard to operations exists.

“Protective services will be required whenever the Contractor is performing work on or adjacent to the Railroad tracks or right-of-way, such as excavating, sheeting, shoring, erection and removal of forms, handling materials, using equipment which by swinging or by failure could foul the track, and when any other type of work being performed, in the opinion of the Railroad, requires such service.”

1.5 Contractor Requirements for Work Affecting the Railroad

- 1.5.1 All matters requiring Railroad Company approval or coordination shall be directed to the Engineer or a duly authorized representative thereof, for forwarding to Metro-North Railroad.
- 1.5.2 Detailed plans and appurtenant data and calculations for any operation which, in the opinion of Metro-North, affect the Railroad, must be submitted to the Engineer or a duly authorized representative thereof, for forwarding to Metro-North Railroad for approval prior to commencement of the work. A Connecticut registered Professional Engineer must stamp all plans and calculations submitted.
- 1.5.3 Permissible Track Outages: Permissible Track Outages are identified in the NOTICE TO CONTRACTOR – WORK ON RAILROAD PROPERTY contained within the Provisions of the Contract. The times identified are the times that the track can be removed from service. If power outages are required, the grounding of the wires will subtract approximately 30 minutes from the outage time.
- 1.5.4 The Contractor shall maintain a minimum of 12-in level shoulder from ends of ties to maintain lateral track support for all excavations and shall not excavate any slope steeper than 1 (vertical) on 2 (horizontal) from the edge of the shoulder. Sheeting shall be required on all excavations where the side of the excavation is intercepted by the Railroad live load influence line. The live load influence line is defined as a line originating at the bottom edge of tie and extending downward at a slope of 1 (vertical) on 1½ (horizontal). Such excavations must be designed to withstand, in addition to all common loads such as soil pressure and hydrostatic pressure, a railroad live load of Cooper E-80.
- 1.5.5 The Contractor shall be required to design and install protective scaffolding over the right-of-way where, at the sole discretion of the Railroad, such scaffolding is necessary to protect the Railroad from possible falling debris; paint or other materials; to protect personnel working about the right-of-way or to provide a platform for personnel, materials and/or equipment. Said scaffolding shall be designed for live load of 200 lbs./sq. ft applied uniformly over the entire structure and a 2 kips concentrated load placed anywhere on the structure. The two loads are not to be applied simultaneously for design purposes.
- 1.5.6 All excavation areas within or near interlocking limits shall be located by the Contractor and inspected by Metro-North Railroad for the purpose of determining conflicts with underground facilities.

Exploratory trenches, 36-in deep and 15-in wide in the form of an “H” with outside dimensions matching and outside of sheeting dimensions are to be hand dug, in areas where railroad underground installations are known to exist. These trenches are for exploratory purposes only and are to be backfilled and compacted immediately. All work outlined above must be done in the presence of a Railroad inspector.

- 1.5.7 Cavities adjacent to sheet piling, created by driving of sheet piling, shall be filled with sand and any distributed ballast must be restored and tampered immediately.
 - 1.5.8 Sheet piling shall be cut off at top of tie during construction and at 36-in below bottom of tie after construction just prior to completion of back filling.
 - 1.5.9 Plans and calculations for sheeting and scaffolding must be submitted to the Engineer for forwarding to the Railroad for approval prior to construction. A Connecticut registered Professional Engineer must stamp plans and calculations.
- 1.6 Requirements for Erection, Demolition and Other Rigging Operations On or Adjacent to Railroad Right-of-Way: The Contractor shall be required to furnish the following information to the Engineer or a duly authorized representative thereof, for forwarding to Metro-North Railroad for their approval prior to the start of any rigging operation over or adjacent to the Railroad right-of-way:
- 1.6.1 Plan view showing locations of cranes, boom length and rigging operating radii, with delivery or disposal locations shown.
 - 1.6.2 Crane rating sheets showing crane(s) to be adequate or 150% of the lift. Crane and boom nomenclature is to be indicated.
 - 1.6.3 Plans and computations showing weight of pick.
 - 1.6.4 Location plan showing obstructions, indicating that the proposed swing is possible.
 - 1.6.5 Plans showing locations and details of mats, planking or special decking as may be required by the Railroad.
 - 1.6.6 Written statement from crane owner giving date of last crane condition and safety inspection and the results of said inspection.
 - 1.6.7 Data sheet listing number, type, size and arrangement of slings, spreader bars or other connecting equipment. Include copies of catalog or information sheets of specialized equipment. All such equipment shall be shown adequate to safely carry 150% of the calculated loading.
 - 1.6.8 A complete procedure is to be included, indicating the order of lifts and repositioning or rehitching of the crane or cranes.
 - 1.6.9 Temporary support of any components or intermediate stages is to be shown.

- 1.6.10 A time schedule of the various stages must be shown, as well as a schedule for the entire lifting procedure.
 - 1.6.11 A Connecticut licensed Professional Engineer must stamp all erection, demolition and rigging plans and calculations submitted to the Railroad.
 - 1.6.12 Operations directly on or adjacent to the operating right-of-way will be performed only at times and under conditions specified by the Railroad's representative.
- 1.7 Ordering Protective Personnel: Metro-North will furnish protective personnel (flagmen, inspectors, maintenance personnel and similar labor) to protect the operation of train traffic during the Contractor's construction activities. Railroad protective services will also be provided in conformance with the Roadway Worker's Protective Act. There will be no charge to the Contractor for Metro-North protective personnel. It is agreed that the providing (or failure to provide) of any conductors, flagmen, groundmen or other employees shall not relieve the Contractor from liability or payment for any damage caused by its operations.
- 1.7.1 The Contractor must obey all instructions from Metro-North representatives on the job site promptly. Failure to follow instructions shall be deemed sufficient cause for closing the job site to the Contractor and its employees.
 - 1.7.2 The Railroad will at its sole discretion, determine the need for and the availability of protective, support personnel. The Railroad will provide protective forces to the extent possible considering operational and maintenance priorities. The Railroad makes no guarantee that protection personnel will be available to meet the Contractor's preferred schedule. Further, no such work may actually commence until the assigned Railroad representative affirmatively advises the Contractor that the necessary protective forces are stationed and that he may proceed.
 - 1.7.3 The assessment of the need for protective services will be based upon a Weekly Railroad Coordination Meeting. At these meetings the Contractor shall provide a Bi-weekly Schedule that will begin on the following Saturday. The furnishing of these schedules shall be in accordance with other Contract provisions. Based on that schedule the Railroad will determine the Protective Service required for the two-week period. Protective services will be reserved for the following week beginning on the Saturday and ordered for the second week of the schedule. It will be the Contractor's responsibility to perform work in accordance with its approved schedule. Variations from the approved schedule may result in

additional and unnecessary costs to the Engineer, Railroad and Contractor.

The Contractor shall base its operations on a 5-consecutive-day work week. The hours of operation during this time shall remain constant. Multiple shifts may be worked.

The Contractor must demonstrate maximum use of protective service personnel ordered. Failure to do so may cause the inability to consistently obtain services.

- 1.7.4 Requests to cancel construction activities and subsequently, the scheduled protective personnel will be also determined at the Weekly Railroad Coordination Meeting held on the Tuesday. At these meetings, the previously scheduled protective service for the week beginning on the following Saturday may be canceled. This will be the only time for cancellation. No ordering of Protective services for the following week will be allowed.
- 1.7.5 The Contractor shall be held responsible for its subcontractors and suppliers. Weather conditions are considered the only acceptable excuse for nonperformance and only on work items that have been identified and agreed to have been weather dependent when scheduled. Activities not presented on the Bi-weekly schedule at the Railroad Coordination Meeting will not be able to commence until it has been inserted into the schedule and presented at the next Protective Service Meeting.
- 1.7.6 Work that requires the support of Railroad personnel shall not be scheduled on the following days, unless the work is of an emergency nature:

New Year's Day
President's Day
Good Friday
Memorial Day
Independence Day
Labor Day
Thanksgiving Day
Day Following Thanksgiving Day
Christmas Eve
Christmas Day
New Year's Eve
The Saturday and Sunday preceding a Monday holiday.
The Saturday and Sunday following a Friday holiday.
The Friday and Monday preceding and following a weekend holiday.

1.8 Requirements for Requesting Track Outages

Track outages as described in the plans and specifications must be requested at the weekly Railroad Construction Coordination Meeting held on the Tuesday for the following week (Saturday through Friday) in which the outage is requested.

- 1.8.1 All procedures, material and equipment must be approved and on site prior to accepting the track outages request.
- 1.8.2 Track outages will be granted based on need for constructability not for convenience.
- 1.8.3 The Contractor must demonstrate the maximum use of track outages by coordinating its activities and work so that various elements and multiple activities are performed during approved outages. Failure to consistently utilize track outages may cause the inability to gain approval of future requests for outages.
- 1.8.4 No new track outages may be initiated the weekend preceding or following the following holidays: Thanksgiving, Christmas, and New Year's. However, long-term continuous outages may extend through these periods.

1.9 Catenary and Transmission Systems/Power Outages

- 1.9.1 Catenary and Transmission Systems - The Contractor shall assume that all the wires on the Railroad Company are energized at all times and must be governed by the restrictions imposed by the Railroad with respect to such electrical circuits. Should it become necessary, in the opinion of the Railroad Engineer to de-energize any wire or wires to insure safety of operation, such wires will be de-energized by the Railroad only during such period that will not interfere with the Railroad's operation. When the de-energizing and re-energizing of wires is deemed necessary, a representative of the Power Department of the Railroad must be on duty and present to arrange for the same. He will notify the Contractor in writing when the wires have been de-energized and also when said wires are to be re-energized.
 - 1.9.1.1 The Contractor is advised that the overhead electrification will remain in place for the duration of the entire project, except where called for on the drawings and in the specifications.
 - 1.9.1.2 Track rails of the Railroad are energized. Particular care must be taken to see that no contact is made between adjoining rails with any material which is a good conductor

of electricity when dry, or material of any nature when wet. Particular care is necessary when any work involving the use of chains, steel rods, cables, pipes, etc., is done. Since the Contractor shall assume the wires and rails of the Railroad will be energized at all times, the Contractor shall require all of its employees, sub-contractors, and others to sign a form similar to the form shown in the NOTICE TO CONTRACTOR – WORK ON RAILROAD PROPERTY contained within the Provisions of the Contract.

1.9.2 Power Outages

1.9.2.1 Catenary Power Outages - A catenary power outage must be scheduled concurrently with a track outage for the track and is restricted to the same periods as specified in the plans and specifications.

1.9.2.2 Metro-North Railroad Power and Signal Distribution Feeder Outages - Outages for feeders can be allowed only during off-peak hours. These outages should be requested at the weekly Railroad Construction Coordination meeting held on the Tuesday for the following week (Saturday through Friday). One set (north or south) side of Railroad of power and signal feeders must be maintained energized at all times.

NOTE: During peak (5:00 a.m. to 10:00 a.m. and 3:30 p.m. to 10:00 p.m., Monday thru Friday) hours of Railroad traffic, both sets (north and south) of power and signal feeders must be energized.

1.10 Safety for Contractor's Employees Working on or Adjacent to the Right-of-Way of the Railroad

1.10.1 Personal Protection Equipment

1.10.1.1 Approved hard hats must be worn by all Contractor employees while on the right-of-way in yard, shop facilities, and construction and/or work sites. Approved safety eyewear must be worn by all Contractor employees while on right-of-way, in yard, shop facilities and construction and/or work sites and in the operating control cab of a moving locomotive or train. Department head and Director of Safety must jointly approve any exclusion.

1.10.1.2 Metro-North Safety Engineer approved reflectorized vest or clothing must be worn by all Contractor employees while on or about tracks and right-of-way and in yards.

- 1.10.1.3 Other protective equipment such as goggles, face shields, safety belts, floatation vests, gloves and respirators shall be issued by the Contractor when required. Protection devices for hearing conservation may be used when determined necessary and safe to do so.

1.10.2 Possession or use of Drinking Intoxicants and Narcotics

- 1.10.2.1 The use of intoxicants, narcotics, marijuana, amphetamines or hallucinogens or while on duty, is prohibited and is sufficient cause for dismissal. Contract employees under medication before or while on duty, must be certain that such use will not affect the safe performance of their duties.

1.10.3 Surveying Equipment

- 1.10.3.1 Measuring tape must be non-metallic to avoid shunting the signal system electric circuits. This will occur when a metallic object is laid across the top of two rails of any track.
- 1.10.3.2 Electrically rated fiberglass elevation rods are to be used to avoid injury in the event contact is made with energized catenary or signal/communication lines. Elevations of catenary wires must be obtained by or under direct supervision of a qualified Metro-North Class "A" groundman.

1.10.4 On or About Track

- 1.10.4.1 Contractor employees must walk on tracks or cross tracks only when necessary, and when accompanied by or with permission from a qualified Metro-North employee.
- 1.10.4.2 Contractor employees must not enter track unless it is necessary in performance of their duty.
- 1.10.4.3 The possession of an umbrella on or about tracks is prohibited.
- 1.10.4.4 Do not rest any object on shoulder while close to moving train.
- 1.10.4.5 Expect equipment to move on any track, in either direction, at any time. Contractor employees must look in both directions and have permission from a qualified Metro-North employee before:
 - a. Fouling track
 - b. Crossing track

- c. Going between or around end of equipment or structure
- d. Moving out from between or under equipment of structure
- e. Getting on or off equipment
- f. Performing any other applicable operation

1.10.4.6 When crossing tracks have permission from a qualified Metro-North employee. Always use approved walkways when available; otherwise take the shortest safe route after looking in both directions. If more than one track is to be crossed, stop and look before crossing each track.

1.10.4.7 When required by a conductor/flagman or other qualified Metro-North employee to vacate tracks, the Contractor employees must comply immediately.

1.10.5 Catenary Electric Systems

1.10.5.1 All overhead wires must be considered energized (LIVE) at all times except when it is known they have been de-energized and properly grounded.

1.10.5.2 Until after wires are de-energized and properly grounded, all Contractor employees must not approach within 10-ft of transmission systems wires, catenary system or signal power wires.

1.10.5.3 At the beginning of each tour of duty, the Class "A" groundman will instruct the Contractor foreman and each Contractor employee in the crew of the dangers surrounding them, calling their particular attention to any hazards to be encountered by the nature of the work to be done.

1.10.5.4 If in the opinion of the Class "A" groundman, any Contractor employee in the crew does not understand the instructions due to not having a proper knowledge of the English language, or for any other reason, such person shall not be permitted to work, or observe.

1.10.5.5 When clearances have been obtained and the wires, equipment or apparatus properly grounded, the Class "A" groundman will indicate to the Contractor foreman and the crew the location of wires, equipment or apparatus from which power has been removed and the location of the grounding devices applied. The Class "A" groundman must obtain on standard form, the signature of the Contractor foreman indicating that he and the crew have

been so instructed, and will confine their work within the limits as outlined to them by the Class "A" groundman.

- 1.10.5.6 When the Class "A" groundman leaves its crew for any reason, he must notify the Contractor foreman and each person in the crew to stop all work in the vicinity of the wires, personally assuring himself that all persons have moved to a safe distance away from its departure. The Class "A" groundman will obtain the signature of the Contractor foreman on standard form, that he and the crew have been informed that the Class "A" groundman is leaving the gang and they will not resume work until advised to do so on return of the Class "A" groundman.
- 1.10.5.7 When the clearances are to be released, the Class "A" groundman will inform the Contractor foreman and each other Contractor employee and will personally observe that all persons have moved to a safe distance from the wires, equipment or apparatus to be energized, before removing the grounding devices. He will obtain the signature of the Contractor foreman, on a standard form, stating that he and the gang have been advised that the wires, equipment or apparatus will be energized, and that they will remain at a safe distance from them until informed otherwise by the Class "A" groundman.
- 1.10.5.8 The Class "A" groundman will inform the Contractor foreman if any Contractor employee on the job is unsafe and will not comply with instructions. If trouble is experienced with the Contractor foreman in maintaining safe working conditions, the Class "A" groundman will immediately notify its supervisor.

1.10.6 Aerial Catenary Construction by Qualified Contractor Employees

- 1.10.6.1 Aerial catenary work included in this Section shall include all overhead wire work included in the portion of the Contract.
- 1.10.6.2 Aerial catenary work by the Contractor shall be done in accordance with the Railroad's safety rules and in accordance with the NEC.
- 1.10.6.3 Due to the specialty nature of the work, limited construction periods available, and high quality of work required, the aerial catenary construction included within the Contract is to be done only by qualified Contractor employees. Only Contractor employees that meet the requirements of the International Brotherhood of Electrical Worker's standards for Journeyman Lineman and who have

successfully completed a Metro-North power orientation class shall be considered for the work of this Section. The power orientation class will be given periodically and will require less than one-half day to complete. Approval for qualification shall be determined by Metro-North and that approval shall not be unreasonably withheld.

- 1.10.6.4 Metro-North approved Journeyman Lineman shall be issued identification as workers qualified to perform aerial catenary work. Qualified Contractor employees shall work according to the Railroad's MN-290 Electrical Operating Instructions. Qualified employees are authorized and expected to work to within 36-in of 13.5 kV energized overhead catenary. Contractor employees shall not de-energize circuits, place initial grounds, or provide protection for others.
- 1.10.6.5 Apprentice Lineman shall be permitted to assist qualified Journeyman Lineman and work under their direct supervision. Apprentice linemen are prohibited from coming closer than 10-ft from all overhead wires or circuits regardless of whether they have been de-energized or not.

1.10.7 Safety Program and Plan

- 1.10.7.1 Prior to the commencement of work the Contractor shall submit a Working on the Railroad Safety Plan that will include a Program to implement the plan to the Engineer or a duly authorized representative for forwarding to the Railroad for review of compliance with this specification. This plan is separate to the Health and Safety Plan required for other aspects of the project (i.e., lead, excavations, etc.).
- 1.10.7.2 Each employee of the Contractor, subcontractor or others on site shall be given an initial training session prior to being allowed to work on the project, but not on the Railroad Right of Way, at this session the following will be furnished to the employee:
 - a. Safety Orientation for Contract Employees Working on Metro-North Property produced by the Safety Engineer of Metro-North.
 - b. Safety Inspection Checklist
 - c. List of the applicable publications referenced in these specifications with respect to safety and where they are located for review if necessary. The list shall include, but not be limited to, such regulatory

standards and mandates, i.e., OSHA, NIOSH, DOL, NFPA, EPA, FRA, MSDS, etc.

- d. Copy of the applicable corporate safety plan.
- e. Copy of the project Railroad Safety Plan or other project related plans.

The employee shall sign the standard form for acknowledgement of the above-noted documents.

1.10.7.3 As soon as possible after the initial training, the employee shall also be given a one-hour training session administered by Metro-North Safety Engineer or its representative. All employees receiving this training will receive a Registered Hard Hat sticker that will identify them from the employees with initial training on the project. No Contractor employees are permitted on the Railroad right-of-way without this training.

1.10.7.4 The Contractor shall hold "TOOL BOX" safety meetings for their employees at least once a week that will be documented and attendees listed.

1.10.7.5 The Contractor personnel shall attend a monthly Metro-North Safety Meeting.

2.0 INSURANCE REQUIREMENTS – METRO-NORTH RAILROAD

2.1 Submission of Insurance: The Contractor engaged in work on the project shall be required, before the Contractor begins work on the project, to provide and to maintain in force during the course of the project, at no cost to Metro-North, insurance described in Paragraph 2.2. These insurance policies are in addition to any other forms or insurance or bonds required under the Terms of the Contract.

2.2 Insurance: The Contractor shall furnish evidence that, with respect to the operations it performs, carries Workmen's Compensation Insurance and Public Liability and Property Damage Insurance covering all the Contractor's operations in any way connected with the project, and to furnish evidence of such policy to Metro-North.

2.2.1 Contractor's Public Liability and Property Damage Insurance – The Contractor shall furnish evidence that, with respect to the operations it performs, it carries regular Contractor's Public Liability Insurance providing for a limit of not less than \$2,000,000 single limit, bodily injury and/or property damage combined, for damages arising out of bodily injuries to or death of all persons in any one occurrence and for damage to or destruction of property, including the loss of use thereof, in any one occurrence.

- 2.2.2 Contractor's Protective Public and Property Damage Liability Insurance – The Contractor shall furnish evidence that, with respect to the operations performed by Subcontractors, it carries in its own behalf regular Contractor's Protective Public Liability Insurance providing for a limit of not less than \$2,000,000, single limit, bodily injury and/or property damage combined, for damages arising out of bodily injuries to or death of all persons in any one occurrence and for damage to or destruction of property, including the loss of use thereof, in any one occurrence.
- 2.2.3 Railroad's Protective Public Liability Insurance – In addition to the above, the Contractor shall furnish evidence that, with respect to the operations it or any of its subcontractors perform, it has provided Railroad Protective Public Liability Insurance (AAR-AASHTO Form) in the name of the Metro-North Railroad providing for a limit of not less than \$2,000,000 single limit, bodily injury and/or property damage combined, for damages arising out of bodily injuries to or death of all persons in any one occurrence for damage to or destruction of property, including the loss of use thereof, in any one occurrence. Such insurance shall be furnished with an aggregate of less than \$6,000,000 for all damages as a result of more than one occurrence. The named insured shall include:

Metro-North Commuter Railroad
Metropolitan Transportation Authority of New York
Connecticut Department of Transportation
Consolidated Rail Corporation
National Railroad Passenger Corporation
Providence and Worcester Railroad Company

The insurance hereinbefore specified shall be carried until all work on the project is satisfactorily completed and formally accepted. Failure to carry or keep such insurance in force until all work is satisfactorily completed shall constitute a violation of the project Contract.

The Contractor shall furnish to Metro-North a signed copy of the policy for Contractor's Public Liability Insurance and Protective Public Liability Insurance and the original copy of the Railroad Protective Public Liability Insurance. If any work is subcontracted, the Contractor shall furnish a signed copy of the policy for Contractor's Public Liability Insurance.

This policy shall be endorsed to the effect that for the purposes of this insurance, the employees of the Railroad Company, as listed below, shall be considered the same as regular employees of the Contractor:

- 2.2.3.1 Any watchman, flagman and similar employee who is employed by the Railroad Company and is specifically assigned or furnished by the Railroad Company for work in connection with the Project.

2.2.3.2 Any employee of the Railroad Company while operating the work trains or other equipment while engaged in the performance of work directly involved in this Contract.

2.2.4 The insurance described in Paragraphs 2.2.1, 2.2.2 and 2.2.3 above, shall be endorsed to provide for not less than 30 days advance written notice to Metro-North of any change or cancellation of policies. Said notice shall be sent to the individual identified in the NOTICE TO CONTRACTOR – WORK ON RAILROAD PROPERTY contained within the Provisions of the Contract. Work may not proceed on Metro-North property until all insurance requirements have been met to the satisfaction of Metro-North's Engineer.

3.0 COSTS ASSOCIATED WITH THIS SPECIFICATION

- 3.1 There shall be no direct payment for this work, regulatory requirements, traffic regulation, administering of the specification, coordination and incidentals to fulfill the requirements of this specification. The cost thereof will be considered as included in the general cost of the work and distributed in all items.
- 3.2 Any work, material's supplied, inspections and protective services by Metro-North as described in the plans and specification expressly needed for the construction of the project will be compensated by the Engineer on a separate agreement."

1.05.07 -- Coordination with Work by Other Parties: is supplemented as follows:

Refer to NOTICE TO CONTRACTOR – WORK ON RAILROAD PROPERTY.

SECTION 1.06 – CONTROL OF MATERIALS

1.06.01--Source of Supply and Quality:

Delete the last paragraph: “When one manufacturer’s product . . . and Materials Certificate.”

1.06.08--Warranties, Guarantees and Instruction Sheets:

Delete the entire Article.

SECTION 1.07 – LEGAL RELATIONS AND RESPONSIBILITIES

Delete Article 1.07.07 in its entirety and replace it with the following:

1.07.07—Safety and Public Convenience: The Contractor shall conduct the Project work at all times in such a manner as to ensure the least possible obstruction to traffic. In a manner acceptable to the Engineer, the Contractor shall provide for the convenience and interests of the general public; the traveling public; parties residing along or adjacent to the highway or Project Site; and parties owning, occupying or using property adjacent to the Project Site, such as commuters, workers, tenants, lessors and operating agencies.

Notwithstanding any other Contract provision, the Contractor shall not close to normal pedestrian or vehicular traffic any section of road, access drive, parking lot, sidewalk, station platform, railroad track, bus stop, runway, taxiway, occupied space within a Site, or occupied space within a building, except with the written permission of the Engineer.

All equipment, materials, equipment or material storage areas, and work areas must be placed, located, and used in ways that do not create a hazard to people or property, especially in areas open to public pedestrian or vehicular traffic. All equipment and materials shall be placed or stored in such a way and in such locations as will not create a hazard to the traveling public or reduce sight lines. In an area unprotected by barriers or other means, equipment and materials must not be stored within 30 feet of any traveled way.

The Contractor must always erect barriers and warning signs between any of its work or storage areas and any area open to public, pedestrian, or vehicular traffic. Such barriers and signs must comply with all laws and regulations, including any applicable codes.

The Contractor must arrange for temporary lighting, snow and ice removal, security against vandalism and theft, and protection against excessive precipitation runoff within its Project work and storage areas, and within other areas specifically designated in the Contract.

In addition to meeting the requirements of Section 9.71, the Contractor shall take all precautions necessary and reasonable for the protection of all persons, including, but not limited to, employees of the Contractor or the Department, and for the protection of property, until the Engineer notifies the Contractor in writing that the Project or the pertinent portion of the Project has been completed to the Engineer's satisfaction.

The Contractor shall comply with the safety provisions of applicable laws, including building and construction codes and the latest edition of the CFR. The Contractor must make available for reference in its field office, throughout the duration of the Project, a copy of the latest edition and all supplements of the CFR pertaining to OSHA.

The Contractor shall make available to the Contractor's employees, subcontractors, the Engineer, and the public, all information pursuant to OSHA 29 CFR Part 1926.59 and The Hazard Communication Standard 29 CFR 1910.1200, and shall also maintain a file on each job site containing all MSDS for products in use at the Project. These MSDS shall be made available to the Engineer upon request.

The Contractor shall observe all rules and regulations of the Federal, State, and local health officials. Attention is directed to Federal, State, and local laws, rules, and regulations concerning construction safety and health standards. The Contractor shall not require any worker to work in surroundings or under conditions that are unsanitary, hazardous, or dangerous to the worker's health or safety.

Safety Plan: Before starting work on the Project, the Contractor shall submit to the Engineer a written Safety and Health Plan (hereinafter referred to as the "Plan"). The Plan shall meet or exceed the minimum requirements of this Subsection and any applicable State or Federal regulations.

The Plan shall apply to any work under the Contract whether such work is performed, by way of example and not limitation, by the Contractor's forces, subcontractors, suppliers, or fabricators.

The Plan shall be prepared by the Contractor and submitted to the Engineer for review before the actual start of work on the Project. Within ten (10) calendar days of receipt, the Engineer will determine whether or not the Plan meets the requirements of this Specification. If the Plan does not meet the requirements of this Specification, it will be returned for revision. Work on the Project may not proceed until the Engineer has accepted the Plan. Nothing herein shall be construed, however, to relieve the Contractor from responsibility for the prosecution of the Project.

The Plan shall conform to the following general format:

1. General Introduction.

- a. Description.** The general introduction of the Plan shall include a statement by the Contractor describing its commitment to maintain a safe work environment for its employees, Department representatives, and the public. Implementation procedures and company policies relative to safety shall be summarized or referenced in the Plan.
 - i. The Plan shall include the names, addresses, and telephone numbers of the Contractor's Project Manager, Project superintendent and/or its designee for safety oversight, all competent persons, and the traffic control coordinator. Any changes to the safety management and oversight for the Project shall be promptly communicated to all concerned.
 - ii. The Plan shall provide guidelines for protecting all personnel from hazards associated with Project operations and activities.

- iii. The Plan shall establish the policies and procedures that are necessary for the Project to be in compliance with the requirements of OSHA and other State and Federal regulatory agencies with jurisdiction, rules, regulations, standards, or guidelines in effect at the time the work is in progress.
 - b. Responsibility, Identification of Personnel, and Certifications.** The Contractor is solely responsible for creating, implementing, and monitoring the Plan.
 - i. The Contractor shall identify and designate on-site supervisory level personnel who shall be responsible for implementing and monitoring the Plan at all times throughout the duration of the Project and shall have authority to take prompt corrective measures to eliminate hazards including the ability to stop work activities.
 - ii. Documentation of training provided to the on-site supervisory level personnel shall be included as part of the Plan.
 - iii. For any work activities wherein the Contractor has identified a competent person as defined by OSHA, that person shall be capable of identifying existing and predictable hazards and have the authority to take prompt corrective measures to eliminate the hazards, including the ability to stop work activities.
 - iv. Documentation of the qualifications of such competent persons identified, including any certifications received, shall be included as part of the Plan.
 - v. The Contractor shall further identify the qualified safety professional responsible for developing the Plan and shall provide that person's qualifications for developing the Plan which shall include, but not be limited to, education, training, certifications, and experience in developing this type of Plan.
 - vi. The Plan shall contain a certification executed by the qualified safety professional that developed the Plan, stating that the Plan complies with OSHA and other applicable State and Federal regulatory agencies with jurisdiction, rules, regulations, standards, or guidelines in effect at the time the work is in progress.
- 2. Elements of the Plan.** The Plan shall address, but not be limited to, the following elements:
- a. Management Safety Policy and Implementation Statement.**
 - i. The Plan shall describe in detail the means by which the Contractor shall implement and monitor the Plan. Implementation and monitoring shall also mean that the Plan shall be a document with provision for change to update the Plan with new information on a yearly basis at a minimum and shall include new practices or procedures, changing site and environmental conditions, or other situations that could adversely affect site personnel. The Plan shall provide guidelines for protecting all personnel from hazards associated with Project operations and activities.
 - b. Emergency Telephone Numbers.**
 - c. Personnel Responsibilities.**
 - i. Management responsibilities
 - ii. Responsibilities of Supervisor(s)
 - iii. Site safety officer(s) responsibilities

- iv. Employee responsibilities
- v. Competent person(s) as defined by OSHA responsibilities
- d. Training.**
 - i. Regulatory
 - ii. Documentation
 - iii. Site hazard assessment -Daily employee awareness of site operations
- e. Safety Rules.**
 - i. General safety rules
 - ii. Personal protective equipment
 - iii. Housekeeping
- f. Safety Checklists.**
 - i. Project safety-planning checklist
 - ii. Emergency plans and procedures checklist
 - iii. Documentation checklist
 - iv. Protective materials and equipment checklist
- g. Traffic Control Coordinator Inspections.**
 - i. Responsible person
 - ii. Frequency
 - iii. Documentation of actions taken
- h. Record Keeping.**
 - i. OSHA 200 log
- i. Reporting.**
 - i. Accident(s)
 - ii. On site
 - iii. Legal notice requirement
 - iv. Public liability
 - v. Property damage
 - vi. Department of Labor
 - vii. Hazard Communications
- j. Additional Procedures for Project Specific Situations as Applicable.**
 - i. Compressed gas cylinders
 - ii. Confined spaces
 - iii. Cranes
 - iv. Crystalline silica (stone, masonry, concrete, and brick dust)
 - v. Electrical
 - vi. Equipment operators
 - vii. Fall protection
 - viii. Hand and power tools
 - ix. Hearing conservation
 - x. Highway safety
 - xi. Lead health and safety plan
 - xii. Lock out/tag out
 - xiii. Materials handling, storage, use, and disposal

- xiv. Areas of environmental concern
- xv. Night work
- xvi. Personal protective equipment
- xvii. Project entry and exit
- xviii. Respiratory protection
- xix. Sanitation
- xx. Signs, signals, and barricades
- xxi. Subcontractors
- xxii. Trenching

3. Appendix for Environmental Health and Safety Plan (HASP). If environmental hazards are identified in the Contract, an Environmental HASP shall be included in an appendix to the Plan, or in a separate document. References to any Environmental HASP shall be included within the Plan, where appropriate.

The Plan shall be kept on the site and shall apply and be available to all workers and all other authorized persons entering the work site. Copies of all updates to the Plan shall be promptly supplied to the Engineer.

If at any time during the Project the Engineer determines that the Contractor is not complying with the requirements of this provision or the updated Plan, the Contractor shall correct such deficiencies immediately. Failure to remediate such deficiencies may result in suspension of the Contractor's operations until the deficiencies have been corrected. Suspensions ordered due to safety deficiencies will not be considered compensable or excusable delays.

The Contractor is responsible for implementation of the Plan. Pursuant to Article 1.07.10, the Contractor shall indemnify, and save harmless the State from any and all liability related to the Plan in proportion to the extent that the Contractor is held liable for same by an arbiter of competent jurisdiction.

The Contractor shall allow onto the Project site any inspector of OSHA or other legally responsible agency involved in safety and health administration upon presentation of proper credentials, without delay and without the presentation of an inspection warrant.

Article 1.07.10 - Contractor's Duty to Indemnify the State against Claims for Injury or Damage:

Add the following after the only paragraph:

"It is further understood and agreed by the parties hereto, that the Contractor shall not use the defense of Sovereign Immunity in the adjustment of claims or in the defense of any suit, including any suit between the State and the Contractor, unless requested to do so by the State."

SECTION 1.08 – PROSECUTION AND PROGRESS

1.08.03 – Prosecution of Work – Add the following:

STAGE CONSTRUCTION

The Project staging and sequence of construction is depicted in the Maintenance and Protection of Traffic Plans in the plan drawings. No change to the Project staging will be allowed without prior approval of the Engineer.

The contractor shall not be permitted to interrupt traffic for any continuous period of time until the following conditions are satisfied:

1. The Contractor provides written evidence of proper notification of all affected parties including the Town of Darien and emergency services servicing the area;
2. The Contractor has secured all of the required approvals from the Engineer;
3. The Contractor has, as much as practical, all of the required materials needed on the site or readily available for that construction which requires the interruption of traffic.

1.08.04 – Limitation of Operations – Add the following:

Refer to NOTICE TO CONTRACTOR – LIMITATION OF CONTRACTOR OPERATIONS for additional limitations.

The Contractor is advised that continuity of station operations and street traffic on adjacent local streets must be maintained throughout construction. In addition, the operation of railroad and public utilities on and adjacent to the site must not be compromised.

The Contractor shall plan and perform the Project work in such a manner and in such sequence as will cause as little interference as is practicable with vehicular, railroad, aircraft, pedestrian or other traffic. The Contractor shall cooperate with any utilities involved in or affected by the Project operations, and shall schedule its operations in accordance with Article 1.05.06.

The Contractor shall give the Engineer 14 days' advance written notice of any proposed changes in Project activities that will alter vehicular traffic patterns, causing lane shifts, temporary closure of a lane, or lane reductions, or any other alteration of railroad, aircraft, and pedestrian or other traffic patterns affecting usage of such a transportation facility by the traveling public. Additionally, the Contractor shall give the Engineer 28 days' advance written notice of any proposed changes in Project activities that will alter vehicular traffic patterns causing permanent closure of a lane, closure of a roadway, traffic stoppages, weekend traffic shifts or any detours affecting the usage of such transportation facility by the traveling public. This advance notification will allow the Department to publish news releases and provide public radio announcements to inform the public of revised traffic patterns or possible traffic delays. Failure of the Contractor to provide such timely notice will subject the Contractor to stop work orders

until such time as required notice have run from either the Contractor's giving of the relevant notice or the Department's discovery of the pertinent alteration of traffic conditions.

TIME RESTRICTIONS

In order to provide for traffic operations, as outlined in the Special Provisions "Maintenance and Protection of Traffic", the Contractor will not be permitted to perform any work that will interfere with existing traffic operations on all project roadways as follows:

On the Following State Observed Legal Holidays:

New Year's Day
 Good Friday, Easter
 Memorial Day
 Independence Day
 Labor Day
 Columbus Day
 Thanksgiving Day
 Christmas Day

HOLLOW TREE RIDGE ROAD, HEIGHTS ROAD, LEDGE ROAD, AND NOROTON AVENUE

The Contractor will not be allowed to perform any work that will interfere with the existing number of lanes of traffic, including turning lanes, at all times. Access and egress to all adjacent properties shall be maintained at all times.

PASSENGER DROP-OFF AREA AND PARKING LOT TO THE NORTH OF TRACKS

The Contractor shall maintain and protect the existing travel way and parking spaces within the passenger drop-off area to the north of the tracks, Sunday through Saturday, between 6:00 a.m. and 10:00 p.m.

The Contractor may close the western-most entrance to the one-way drive at Heights Road and direct incoming vehicular traffic through the drop-off area exit (middle curb cut) located at Heights Road, Sunday through Saturday, between 10:00 p.m. and 6:00 a.m.

PARKING LOT TO THE SOUTH OF TRACK 4

The Contractor shall maintain a 24-foot minimum travel way between the edge of his work zone (to the south of Track 4) and the adjacent northern line of central parking spaces, Sunday through Saturday, between 6:00 a.m. and 10:00 p.m.

The Contractor may reserve specific parking spaces for truck deliveries and for the maneuvering of construction vehicles, Sunday through Saturday, between 12:00 a.m. and 6:00 a.m.

SIGHT LINE RESTRICTIONS

In accordance with Article 1.07.07 – Public Convenience and Safety, the Contractor will not be permitted to park construction vehicles, including the vehicles of its workers, nor store materials or equipment, in locations on or adjacent to roadways where the sight lines of roadway users is reduced due to such parking or storage of materials or equipment. Such restricted areas may be noted on the “Maintenance and Protection of Traffic Plans,” or shall be as determined by the Engineer.

OTHER LIMITATIONS

The field installation and removal of signing patterns shall constitute interference with existing traffic operations and shall not be allowed except during the allowable periods.

The contractor is responsible to clear out any snow in the work area during the duration and at the end of the work shift. The contractor shall clear his work area accessible by the public at the inclusion of his work shift of any snow, equipment, material piles etc. The contractor is advised that he may be refused permission to work on the site during inclement weather conditions.

1.08.07 - Determination of Contract Time:

Add the following:

“The Contractor shall comply with the milestones, and the specific number of days allowed for milestone completions, stipulated in CONTRACT TIME AND LIQUIDATED DAMAGES.”

SECTION 4.06 BITUMINOUS CONCRETE

Section 4.06 is being deleted in its entirety and replaced with the following:

4.06.01—Description

4.06.02—Materials

4.06.03—Construction Methods

4.06.04—Method of Measurement

4.06.05—Basis of Payment

4.06.01—Description: Work under this section shall include the production, delivery and placement of a non-segregated, smooth and dense bituminous concrete mixture brought to proper grade and cross section. This section shall also include the method and construction of longitudinal joints. The Contractor shall furnish ConnDOT with a Quality Control Plan (QCP) as described in Article 4.06.03.

The terms listed below as used in this specification are defined as:

Bituminous Concrete: A concrete material that uses a bituminous material (typically asphalt) as the binding agent and stone and sand as the principal aggregate components. Bituminous concrete may also contain any of a number of additives engineered to modify specific properties and/or behavior of the concrete material. For the purposes of this Specification, references to bituminous concrete apply to all of its sub-categories, for instance those defined on the basis of production and placement temperatures, such as hot-mix asphalt (HMA) or warm-mix asphalt (WMA), or those defined on the basis of composition, such as those containing polymer-modified asphalt (PMA).

Course: A lift or multiple lifts comprised of the same bituminous concrete mixture placed as part of the pavement structure.

Density Lot: All material placed in a single lift and as defined in Article 4.06.03.

Disintegration: Wearing away or fragmentation of the pavement. Disintegration will be evident in the following forms: Polishing, weathering-oxidizing, scaling, spalling, raveling, potholes or loss of material.

Dispute Resolution: A procedure used to resolve conflicts resulting from discrepancies between the Engineer and the Contractor's density results that may affect payment.

Hot Mix Asphalt (HMA): A bituminous concrete mixture typically produced at 325°F.

Lift: An application of a bituminous concrete mixture placed and compacted to a specified thickness in a single paver pass.

Polymer Modified Asphalt (PMA): A bituminous concrete mixture containing a polymer modified asphalt binder in accordance with contract specifications. All PMA mixtures shall incorporate a qualified warm mix technology.

Production Lot: All material placed during a continuous daily paving operation.

Quality Assurance (QA): All those planned and systematic actions necessary to provide confidence that a product or facility will perform as designed.

Quality Control (QC): The sum total of activities performed by the vendor (Producer, Manufacturer, and Contractor) to ensure that a product meets contract specification requirements.

Superpave: A bituminous concrete mix design used in mixtures designated as “S*” Where “S” indicates Superpave and * indicates the sieve related to the nominal maximum aggregate size of the mix.

Segregation: A non-uniform distribution of a bituminous concrete mixture in terms of gradation, temperature, or volumetric properties.

Warm Mix Asphalt (WMA): A bituminous concrete mixture that can be produced and placed at reduced temperatures than HMA using a qualified additive or technology.

4.06.02—Materials: All materials shall conform to the requirements of Section M.04.

1. Materials Supply: The bituminous concrete mixture must be from one source of supply and originate from one Plant unless authorized by the Engineer. Bituminous Concrete plant QCP requirements are defined in Section M.04.

2. Recycled Materials: Reclaimed Asphalt Pavement (RAP), Crushed Recycled Container Glass (CRCG), Recycled Asphalt Shingles (RAS), or crumb rubber (CR) from recycled tires may be incorporated in bituminous concrete mixtures in accordance with Section M.04 and Project Specifications. CRCG and RAS shall not be used in the surface course.

4.06.03—Construction Methods:

1. Material Documentation: All vendors producing bituminous concrete must have their truck-weighing scales, storage scales, and mixing plant automated to provide a detailed ticket.

Delivery tickets shall include the following information:

- a. State of Connecticut printed on ticket.
- b. Name of producer, identification of plant, and specific storage bin (silo) if used.
- c. Date and time of day.

- d. Mixture Designation; Mix type and level Curb mixtures for machine-placed curbing must state "curb mix only".
- e. If RAP is used, the plant printouts shall include the RAP dry weight, percentage and daily moisture content.
- f. If RAS is used, the plant printouts shall include the RAS dry weight and percentage daily moisture content.
- g. The delivery ticket for all mixes produced with Warm Mix Technology must indicate the additive name, and the injection rate (water or additive) incorporated at the HMA plant. The delivery ticket for all mixes produced with pre-blended WMA additive must indicate the name of the WMA Technology.
- h. Net weight of mixture loaded into truck (When RAP and/or RAS is used the moisture content shall be excluded from mixture net weight).
- i. Gross weight (Either equal to the net weight plus the tare weight or the loaded scale weight).
- j. Tare weight of truck – Daily scale weight.
- k. Project number, purchase order number, name of Contractor (if Contractor other than Producer).
- l. Truck number for specific identification of truck.
- m. Individual aggregate, Recycled Materials, and virgin asphalt high/target/low weights. For drum plants and silo loadings, the plant printouts shall be produced at 5 minute intervals maintained by the vendor for a period of three years after the completion of the project.
- n. For every mixture designation the running daily total delivered and sequential load number.

The net weight of mixture loaded into the truck must be equal to the cumulative measured weight of its components.

The Contractor must notify the Engineer immediately if, during the production day, there is a malfunction of the weighing or recording system in the automated plant or truck-weighing scales. Manually written tickets containing all required information will be allowed for one hour, but for no longer, provided that each load is weighed on State-approved scales. At the Engineer's sole discretion, trucks may be approved to leave the plant if a State inspector is present to monitor weighing. If such a malfunction is not fixed within forty-eight hours, mixture will not be approved to leave the plant until the system is fixed to the Engineer's satisfaction. No damages will be considered should the State be unable to provide an inspector at the plant.

The State reserves the right to have an inspector present to monitor batching and /or weighing operations.

2. Transportation of Mixture: Trucks with loads of bituminous concrete being delivered to State projects must not exceed the statutory or permitted load limits referred to as gross vehicle weight (GVW). The Contractor shall furnish a list of all vehicles and allowable weights transporting mixture.

The State reserves the right to check the gross and tare weight of any delivery truck. A variation of 0.4 percent or less in the gross or tare weight shown on the delivery ticket and the certified scale weight shall be considered evidence that the weight shown on the delivery ticket is correct. If the gross or tare weight varies from that shown on the delivery ticket by more than 0.4 percent, the Engineer will recalculate the net weight. The Contractor shall take action to correct discrepancy to the satisfaction of the Engineer.

If a truck delivers mixture to the project and the ticket indicates that the truck is overweight, the load will not be rejected but a "Measured Weight Adjustment" will be taken in accordance with Article 4.06.04.

The mixture shall be transported from the mixing plant in trucks that have previously been cleaned of all foreign material and that have no gaps through which mixture might inadvertently escape. The Contractor shall take care in loading trucks uniformly so that segregation is minimized. Loaded trucks shall be tightly covered with waterproof covers acceptable to the Engineer. Mesh covers are prohibited. The front and rear of the cover must be fastened to minimize air infiltration. The Contractor shall assure that all trucks are in conformance with this specification. Trucks found not to be in conformance shall not be allowed to be loaded until re-inspected to the satisfaction of the Engineer.

Truck body coating and cleaning agents must not have a deleterious effect on the transported mixture. The use of solvents or fuel oil, in any concentration, is strictly prohibited for the coating of the inside of truck bodies. When acceptable coating or agents are applied, truck bodies shall be raised immediately prior to loading to remove any excess agent in an environmentally acceptable manner.

3. Paving Equipment: The Contractor shall have the necessary paving and compaction equipment at the project site to perform the work. All equipment shall be in good working order and any equipment that is worn, defective or inadequate for performance of the work shall be repaired or replaced by the Contractor to the satisfaction of the Engineer. During the paving operation, the use of solvents or fuel oil, in any concentration, is strictly prohibited as a release agent or cleaner on any paving equipment (i.e., rollers, pavers, transfer devices, etc.).

Refueling of equipment is prohibited in any location on the paving project where fuel might come in contact with bituminous concrete mixtures already placed or to be placed. Solvents for use in cleaning mechanical equipment or hand tools shall be stored clear of areas paved or to be paved. Before any such equipment and tools are cleaned, they shall be moved off the paved or to be paved area; and they shall not be returned for use until after they have been allowed to dry.

Pavers: Each paver shall have a receiving hopper with sufficient capacity to provide for a uniform spreading operation and a distribution system that places the mix uniformly, without segregation. The paver shall be equipped with and use a vibratory screed system with heaters or burners. The screed system shall be capable of producing a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture. Pavers with extendible

screed units as part of the system shall have auger extensions and tunnel extenders as necessary. Automatic screed controls for grade and slope shall be used at all times unless otherwise authorized by the Engineer. The controls shall automatically adjust the screed to compensate for irregularities in the preceding course or existing base. The controls shall maintain the proper transverse slope and be readily adjustable, and shall operate from a fixed or moving reference such as a grade wire or floating beam.

Rollers: All rollers shall be self-propelled and designed for compaction of bituminous concrete. Rollers types shall include steel-wheeled, pneumatic or a combination thereof and may be capable of operating in a static or dynamic mode. Rollers that operate in a dynamic mode shall have drums that use a vibratory or oscillatory system or combination of. The vibratory system achieves compaction through vertical amplitude forces. Rollers with this system shall be equipped with indicators that provide the operator with amplitude, frequency and speed settings/readouts to measure the impacts per foot during the compaction process. The oscillatory system achieves compaction through horizontal shear forces. Rollers with this system shall be equipped with frequency indicators. Rollers can operate in the dynamic mode using the oscillatory system on concrete structures such as bridges and catch basins if at the lowest frequency setting.

Pneumatic tire rollers shall be self-propelled and equipped with wide-tread compaction tires capable of exerting an average contact pressure from 60 to 90 pounds per square inch uniformly over the surface, adjusting ballast and tire inflation pressure as required. The Contractor shall furnish evidence regarding tire size; pressure and loading to confirm that the proper contact pressure is being developed and that the loading and contact pressure is uniform for all wheels.

Lighting: For paving operations, which will be performed during hours of darkness, the paving equipment shall be equipped with lighting fixtures as described below, or with approved lighting fixtures of equivalent light output characteristics. Lighting shall maximize the illumination on each task and minimize glare to passing traffic. The Contractor shall provide generators on rollers and pavers of the type, size, and wattage, to adequately furnish electric power to operate the specified lighting equipment. The lighting options and minimum number of fixtures are listed in Tables 4.06-1 and 4.06-2:

TABLE 4.06-1: Paver Lighting

Option	Fixture Configuration	Fixture Quantity	Requirement
1	Type A	3	Mount over screed area
	Type B (narrow) or Type C (spot)	2	Aim to auger and guideline
	Type B (wide) or Type C (flood)	2	Aim 25 feet behind paving machine
2	Type D Balloon	2	Mount over screed area

TABLE 4.06-2: Roller Lighting

Option	Fixture Configuration*	Fixture Quantity	Requirement
1	Type B (wide)	2	Aim 50 feet in front of and behind roller
	Type B (narrow)	2	Aim 100 feet in front of and behind roller
2	Type C (flood)	2	Aim 50 feet in front of and behind roller
	Type C (spot)	2	Aim 100 feet in front of and behind roller
3	Type D Balloon	1	Mount above the roller

*All fixtures shall be mounted above the roller.

Type A: Fluorescent fixture shall be heavy-duty industrial type. Each fixture shall have a minimum output of 8,000 lumens. The fixtures shall be mounted horizontally, and be designed for continuous row installation.

Type B: Each floodlight fixture shall have a minimum output of 18,000 lumens.

Type C: Each fixture shall have a minimum output of 19,000 lumens.

Type D: Balloon light: Each balloon light fixture shall have a minimum output of 50,000 lumens, and emit light equally in all directions.

Material Transfer Vehicle (MTV): A MTV shall be used when placing a bituminous concrete surface course as indicated in the contract documents. A surface course is defined as the total thickness of the same bituminous concrete mix that extends up to and includes the final wearing surface whether it is placed in a single or multiple lifts, and regardless of any time delays between lifts.

The MTV must be a self-propelled vehicle specifically designed for the purpose of delivering the bituminous concrete mixture from the delivery truck to the paver. The MTV must continuously remix the bituminous concrete mixture throughout the placement process.

The use of a MTV will be subject to the requirements stated in Article 1.07.05- Load Restrictions. The Engineer may limit the use of the vehicle if it is determined that the use of the MTV may damage highway components, utilities, or bridges. The Contractor shall submit to the Engineer at time of pre-construction the following information:

- The make and model of the MTV to be used.
- The individual axle weights and axle spacing for each separate piece of paving equipment (haul vehicle, MTV and paver).
- A working drawing showing the axle spacing in combination with all three pieces of equipment that will comprise the paving echelon.

4. Test Section: The Engineer may require the Contractor to place a test section whenever the requirements of this specification or Section M.04 are not met.

The Contractor shall submit the quantity of mixture to be placed and the location of the test section for review and acceptance by the Engineer. The equipment used in the construction of a passing test section shall be used throughout production.

If a test section fails to meet specifications, the Contractor shall stop production, make necessary adjustments to the job mix formula, plant operations, or procedures for placement and compaction. The Contractor shall construct test sections, as allowed by the Engineer, until all the required specifications are met. All test sections shall also be subject to removal as set forth in Article 1.06.04.

5. Transitions for Roadway Surface: Transitions shall be formed at any point on the roadway where the pavement surface deviates, vertically, from the uniform longitudinal profile as specified on the plans. Whether formed by milling or by bituminous concrete mixture, all transition lengths shall conform to the criteria below unless otherwise specified.

Permanent Transitions: A permanent transition is defined as any transition that remains as a permanent part of the work. All permanent transitions, leading and trailing ends shall meet the following length requirements:

- a) Posted speed limit is greater than 35 MPH: 30 feet per inch of vertical change (thickness)
- b) Posted speed limit is 35 MPH or less: 15 feet per inch of vertical change (thickness).
- c) Bridge Overpass and underpass transition length will be 75 feet either
 - (1) Before and after the bridge expansion joint, or
 - (2) Before or after the parapet face of the overpass.

In areas where it is impractical to use the above described permanent transition lengths the use of a shorter permanent transition length may be permitted when approved by the Engineer.

Temporary Transitions: A temporary transition is defined as a transition that does not remain a permanent part of the work. All temporary transitions shall meet the following length requirements:

- a) Posted speed limit is greater than 50 MPH
 - (1) Leading Transitions = 15 feet per inch of vertical change (thickness)
 - (2) Trailing Transitions = 6 feet per inch of vertical change (thickness)
- b) Posted speed limit is 40, 45, or 50 MPH
 - (1) Leading and Trailing = 4 feet per inch of vertical change (thickness)
- c) Posted speed limit is 35 MPH or less
 - (1) Leading and Trailing = 3 feet per inch of vertical change (thickness)

Note: Any temporary transition to be in-place over the winter shutdown period or during extended periods of inactivity (more than 14 calendar days) shall conform to the greater than 50 MPH requirements shown above.

6. Spreading and Finishing of Mixture: Prior to the placement of the bituminous concrete, the underlying base course shall be brought to the plan grade and cross section within the allowable tolerance. Immediately before placing the mixture, the area to be surfaced shall be cleaned by sweeping or by other means acceptable to the Engineer. The bituminous concrete mixture shall not be placed whenever the surface is wet or frozen. The Engineer will verify the mix temperature by means of a probe or infrared type of thermometer. A probe type thermometer, verified by the Department on an annual basis, must be used in order to reject a load of mixture based on temperatures outside the range stated in the placement QCP.

Placement: The bituminous concrete mixture shall be placed and compacted to provide a smooth, dense surface with a uniform texture and no segregation at the specified thickness and dimensions indicated in the plans and specifications.

When unforeseen weather conditions prevent further placement of the mix, the Engineer is not obligated to accept or place the bituminous concrete mixture that is in transit from the plant.

In advance of paving, traffic control requirements shall be set up daily, maintained throughout placement, and shall not be removed until all associated work including density testing is completed.

The Contractor shall inspect the newly placed pavement for defects in the mixture or placement before rolling is started. Any deviation from standard crown or section shall be immediately remedied by placing additional mixture or removing surplus mixture. Such defects shall be corrected to the satisfaction of the Engineer.

Where it is impractical due to physical limitations to operate the paving equipment, the Engineer may permit the use of other methods or equipment. Where hand spreading is permitted, the mixture shall be placed by means of suitable shovels and other tools, and in a uniformly loose layer at a thickness that will result in a completed pavement meeting the designed grade and elevation.

Placement Tolerances: Each lift of bituminous concrete placed at a uniform specified thickness shall meet the following requirements for thickness and area. Any pavement exceeding these limits shall be subject to an adjustment or removal. Lift tolerances will not relieve the Contractor from meeting the final designed grade. Lifts of specified non-uniform thickness, i.e. wedge or shim course, shall not be subject to thickness and area adjustments.

- a) Thickness- Where the total thickness of the lift of mixture exceeds that shown on the plans beyond the tolerances shown in Table 4.06-3, the longitudinal limits of such variation including locations and intervals of the measurements will be documented by the Engineer for use in calculating an adjustment in accordance with Article 4.06.04.

TABLE 4.06-3: Thickness Tolerances

Mixture Designation	Lift Tolerance
S1	+/- 3/8 inch
S0.25, S0.375, S0.5	+/- 1/4 inch

Where the thickness of the lift of mixture is less than that shown on the plans beyond the tolerances shown in Table 4.06-3, the Contractor, with the approval of the Engineer, shall take corrective action in accordance with this specification.

- b) Area- Where the width of the lift exceeds that shown on the plans by more than the specified thickness of each lift, the longitudinal limits of such variation including locations and intervals of the measurements will be documented by the Engineer for use in calculating the adjustment in Article 4.06.04.
- c) Delivered Weight of Mixture - When the delivery ticket shows that the truck exceeds the allowable gross weight for the vehicle type the quantity of tons representing the overweight amount will be documented by the Engineer for use in calculating an adjustment in accordance with Article 4.06.04.

Transverse Joints: All transverse joints shall be formed by saw-cutting a sufficient distance back from the previous run, existing bituminous concrete pavement or bituminous concrete driveways to expose the full thickness of the lift. A brush of tack coat shall be used on any cold joint immediately prior to additional bituminous concrete mixture being placed.

Tack Coat Application: Immediately before application, the area to be tacked shall be cleaned by sweeping or by other means acceptable to the Engineer. A thin uniform coating of tack coat shall be applied to the pavement immediately before overlaying and be allowed sufficient time to break (set) prior to any paving equipment or haul vehicles driving on it. All surfaces in contact with the bituminous concrete that have been in place longer than 3 calendar days shall have an application of tack coat. The tack coat shall be applied by a non-gravity pressurized spray system that results in uniform overlapping coverage at an application rate of 0.03 to 0.05 gallons per square yard for a non-milled surface and an application rate of 0.05 to 0.07 gallons per square yard for a milled surface. For areas where both milled and un-milled surfaces occur, the tack coat shall be an application rate of 0.03 to 0.05 gallons per square yard. The Engineer must approve the equipment and the method of measurement prior to use. The material for tack coat shall not be heated in excess of 160°F and shall not be further diluted.

Compaction: The Contractor shall compact the mixture to meet the density requirements as stated in Article 4.06.03 and eliminate all roller marks without displacement, shoving, cracking, or aggregate breakage.

When placing a lift with a specified thickness less than one and one-half (1 ½) inches, or a wedge course, the Contractor shall provide a minimum rolling pattern as determined by the development of a compaction curve. The procedure to be used shall be documented in the Contractor's QCP for placement and demonstrated on the first day of placement.

The use of the vibratory system on concrete structures is prohibited. When approved by the Engineer, the Contractor may operate a roller using an oscillatory system at the lowest frequency setting.

If the Engineer determines that the use of compaction equipment in the dynamic mode may damage highway components, utilities, or adjacent property, the Contractor shall provide alternate compaction equipment. The Engineer may allow the Contractor to operate rollers in the dynamic mode using the oscillatory system at the lowest frequency setting.

Rollers operating in the dynamic mode shall be shut off when changing directions.

These allowances will not relieve the Contractor from meeting pavement compaction requirements.

Surface Requirements: The pavement surface of any lift shall meet the following requirements for smoothness and uniformity. Any irregularity of the surface exceeding these requirements shall be corrected by the Contractor.

- a) Smoothness- Each lift of the surface course shall not vary more than $\frac{1}{4}$ inch from a Contractor-supplied 10 foot straightedge. For all other lifts of bituminous concrete, the tolerance shall be $\frac{3}{8}$ inch. Such tolerance will apply to all paved areas.
- b) Uniformity- The paved surface of the mat and joints shall not exhibit segregation, rutting, cracking, disintegration, flushing or vary in composition as determined by the Engineer.

7. Longitudinal Joint Construction Methods: The Contractor shall use Method I- Notched Wedge Joint (see Figure 4.06-1) when constructing longitudinal joints where lift thicknesses are between $1\frac{1}{2}$ and 3 inches, except for S1mixes. Method II Butt Joint (see Figure 4.06-2) shall be used for lifts less than $1\frac{1}{2}$ inches or greater than 3 inches, and S1mixes. During placement of multiple lifts of bituminous concrete, the longitudinal joint shall be constructed in such a manner that it is located at least 6 inches from the joint in the lift immediately below. The joint in the final lift shall be at the centerline or at lane lines. Each longitudinal joint shall maintain a consistent offset from the centerline of the roadway along its entire length. The difference in elevation between the two faces of any completed longitudinal joint shall not exceed $\frac{1}{4}$ of an inch in any location.

Method I - Notched Wedge Joint:

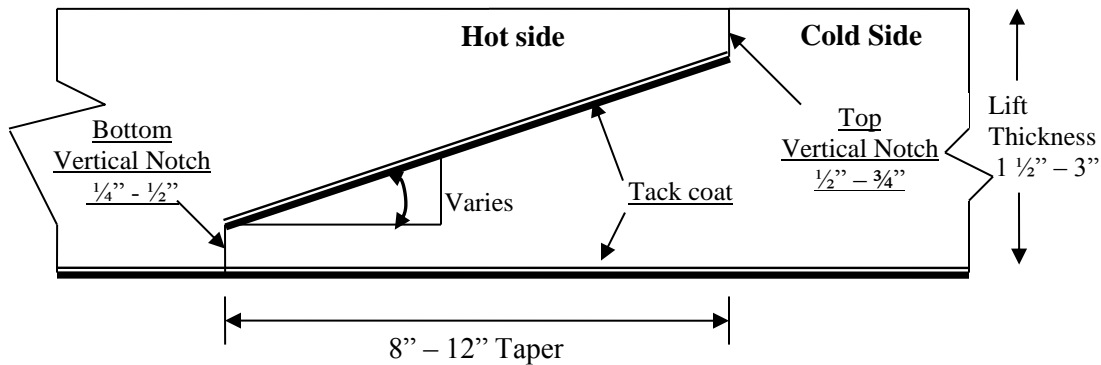


FIGURE 4.06-1: Notched Wedge Joint

A notched wedge joint shall be constructed as shown in Figure 4.06-1 using a device that is attached to the paver screed and is capable of independently adjusting the top and bottom vertical notches. The device shall have an integrated vibratory system.

The taper portion of the wedge joint must be placed over the longitudinal joint in the lift immediately below. The top vertical notch must be located at the centerline or lane line in the final lift. The requirement for paving full width “curb to curb” as described in Method II may be waived if addressed in the QC plan and approved by the Engineer.

The taper portion of the wedge joint shall be evenly compacted using equipment other than the paver or notch wedge joint device.

The taper portion of the wedge joint shall not be exposed to traffic for more than 5 calendar days.

The pavement surface under the wedge joint must have an application of tack coat material. Prior to placing the completing pass (hot side), an application of tack coat must be applied to the exposed surface of the tapered section; regardless of time elapsed between paver passes. The in-place time allowance described in Sub article 4.06.03-7 does not apply to joint construction.

Any exposed wedge joint must be located to allow for the free draining of water from the road surface.

The Engineer reserves the right to define the paving limits when using a wedge joint that will be exposed to traffic.

If Method I, Notched Wedge Joint cannot be used on lifts between 1.5 and 3 inches, Method III Butt Joint may be substituted according to the requirements below for “Method III – Butt Joint with Hot Pour Rubberized Asphalt Treatment.”

Method II - Butt Joint:

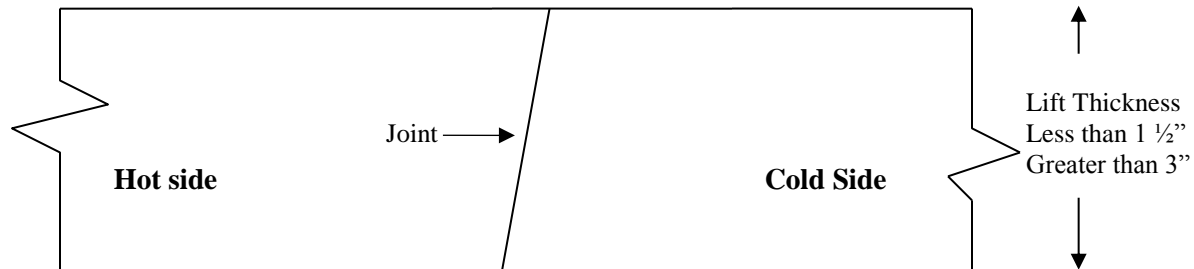


FIGURE 4.06-2: Butt Joint

When adjoining passes are placed, the Contractor shall utilize equipment that creates a near vertical edge (refer to Figure 4.06-2). The completing pass (hot side) shall have sufficient mixture so that the compacted thickness is not less than the previous pass (cold side). The end gate on the paver should be set so there is an overlap onto the cold side of the joint.

The Contractor shall not allow any butt joint to be incomplete at the end of a work shift unless otherwise allowed by the Engineer. When using this method, the Contractor is not allowed to leave a vertical edge exposed at the end of a work shift and must complete paving of the roadway full width “curb to curb.”

Method III- Butt Joint with Hot Poured Rubberized Asphalt Treatment: If Method I Wedge Joint cannot be used due to physical constraints in certain limited locations; the contractor may submit a request in writing for approval by the Engineer, to utilize Method III Butt Joint as a substitution in those locations. There shall be no additional measurement or payment made when the Method III Butt Joint is substituted for the Method I Notched Wedge Joint. When required by the contract or approved by the Engineer, Method III (see Figure 4.06-3) shall be used.

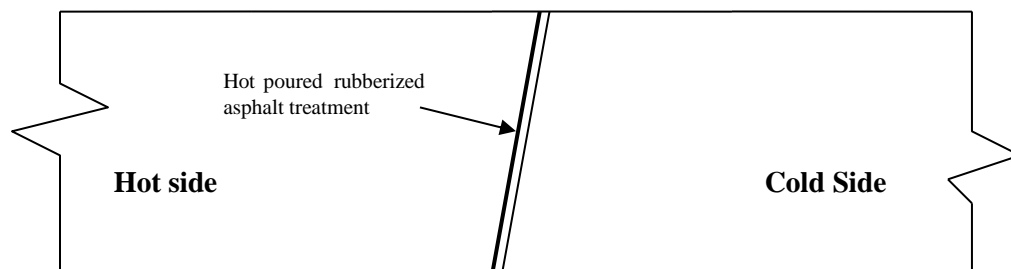


FIGURE 4.06-3: Butt Joint with Hot Poured Rubberized Asphalt Treatment

All of the requirements of Method II must be met with Method III. In addition, the longitudinal vertical edge must be treated with a rubberized joint seal material meeting the requirements of ASTM D 6690, Type 2. The joint sealant shall be placed on the face of the “cold side” of the butt joint as shown above prior to placing the “hot side” of the butt joint. The joint seal material

shall be applied in accordance with the manufacturer's recommendation so as to provide a uniform coverage and avoid excess bleeding onto the newly placed pavement.

8. Contractor Quality Control (QC) Requirements:

The Contractor shall be responsible for maintaining adequate quality control procedures throughout the production and placement operations. Therefore, the Contractor must ensure that the materials, mixture and work provided by Subcontractors, Suppliers and Producers also meet contract specification requirements.

This effort must be documented in Quality Control Plans and address the actions, inspection, or sampling and testing necessary to keep the production and placement operations in control, to determine when an operation has gone out of control and to respond to correct the situation in a timely fashion.

The Standard QCP for production shall consist of the quality control program specific to the production facility.

There are three components to the QCP for placement: a Standard QCP, a Project Summary Sheet that details project specific information, and if applicable a separate Extended Season Paving Plan as required in Section 9 "Temperature and Seasonal Requirements".

The Standard QCP for both production and placement shall be submitted to the Department for approval each calendar year and at a minimum of 30 days prior to production or placement.

Production or placement shall not occur until all QCP components have been approved by the Engineer.

Each QCP shall include the name and qualifications of a Quality Control Manager (QCM). The QCM shall be responsible for the administration of the QCP, and any modifications that may become necessary. The QCM shall have the ability to direct all Contractor personnel on the project during paving operations. All Contractor sampling, inspection and test reports shall be reviewed and signed by the QCM prior to submittal to the Engineer. The QCPs shall also include the name and qualifications of any outside testing laboratory performing any QC functions on behalf of the Contractor.

Approval of the QCP does not relieve the Contractor of its responsibility to comply with the project specifications. The Contractor may modify the QCPs as work progresses and must document the changes in writing prior to resuming operations. These changes include but are not limited to changes in quality control procedures or personnel. The Department reserves the right to deny significant changes to the QCPs.

QCP for Production: Refer to Section M.04.03-1.

QCP for Placement: The Standard QCP, Project Summary Sheet, and Extended Season Paving Plan shall conform to the format provided by the Engineer. The format is available at http://www.ct.gov/dot/lib/dot/documents/dconstruction/pat/qcp_outline_hma_placement.pdf.

The Contractor shall perform all quality control sampling and testing, provide inspection, and exercise management control to ensure that bituminous concrete placement conforms to the requirements as outlined in its QCP during all phases of the work. The Contractor shall document these activities for each day of placement.

The Contractor shall submit complete field density testing and inspection records to the Engineer within 48 hours in a manner acceptable to the Engineer.

The Contractor may obtain one (1) mat core and one (1) joint core per day for process control, provided this process is detailed in the QCP. The results of these process control cores shall not be used to dispute the Department determinations from the acceptance cores. The Contractor shall submit the location of each process control core to the Engineer for approval prior to taking the core. The core holes shall be filled to the same requirements described in Sub article 4.06.03-10.

9. Temperature and Seasonal Requirements: Paving, including placement of temporary pavements, shall be divided into two seasons, “In-Season” and “Extended-Season”. In-Season paving occurs from May 1 – October 14, and Extended Season paving occurs from October 15-April 30. The following requirements shall apply unless otherwise authorized or directed by the Engineer:

- Bituminous concrete mixes shall not be placed when the air or sub base temperature is below 40°F regardless of the season.
- Should paving operations be scheduled during the Extended Season, the Contractor must submit an Extended Season Paving Plan for the project that addresses minimum delivered mix temperature considering WMA, PMA or other additives, maximum paver speed, enhanced rolling patterns and the method to balance mixture delivery and placement operations. Paving during Extended Season shall not commence until the Engineer has approved the plan.

10. Density Testing of Bituminous Concrete Utilizing Core Samples: This procedure describes the frequency and the method the Contractor shall use to obtain pavement cores for acceptance from the project.

Coring shall be performed on each lift specified to a thickness of one and one-half (1 ½) inches or more. All material placed in a lift shall be compacted to the degree specified in Tables 4.06-9 and 4.06-10. The density of each core will be determined using the production lot’s average maximum theoretical specific gravity (Gmm) established during the testing of the parent material at the plant. When there was no testing of the parent material or any Gmm exceeds the specified tolerances in the Department’s current QA Program for Materials, the Engineer will determine

the maximum theoretical density value to be used for density calculations. Bituminous concrete HMA S1 mixes are excluded from the longitudinal joint density requirements.

The Contractor shall extract cores (4 or 6 inch diameter for S0.25, S0.375 and S0.5 mixes, 6 inch diameter for S1.0 mixtures -wet sawed) from sampling locations determined by the Engineer. The Engineer must witness the extraction and labeling of cores, as well as the filling of the core holes. The cores shall be labeled by the Contractor with the project number, lot number, and sub-lot number on the top surface of the core. When labeling the core lot number, include whether the core is from a mat lot or joint lot by using an “M” for a mat core and “J” for a joint core. For example, a core from the first sub-lot of the first mat lot shall be labeled with “Lot M1 – 1”. The first number refers to the lot and the second number refers to the sub-lot. Refer to Figure 4.06-4. The side of the cores shall be labeled with the core lot number and date placed. The project inspector shall fill out a MAT-109 containing the same information to accompany the cores. The Contractor shall deliver the cores and MAT-109 to the Department’s Central Testing Lab in a safe manner to ensure no damage occurs to the cores. The Contractor shall use a container approved by the Engineer. In general the container shall consist of an attached lid container made out of plastic capable of being locked shut and tamper proof. The Contractor shall use foam, bubble wrap, or another suitable material to prevent the cores from being damaged during transportation. Once the cores and MAT-109 are in the container the Engineer will secure the lid using a security seal. The security seal’s identification number must be documented on the MAT-109. The Central Lab will break the security seal and take possession of the cores upon receipt.

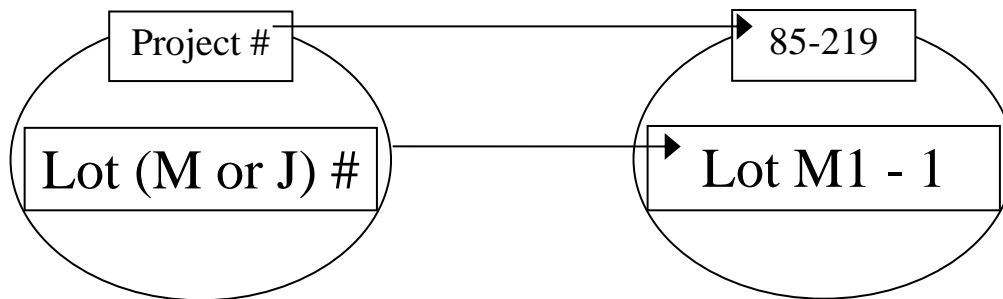


FIGURE 4.06-4: Labeling of Cores

Frequency of sampling is in accordance with the following tables:

TABLE 4.06-4: Testing Requirement for Bridge Density Lot

Length of Each Structure (Feet)	MAT – No. of Cores	JOINT - No. of cores
≤ 500'	See Table 4.06-5(A or B)	See Table 4.06-5(A or B)
501' – 1500'	3	3
1501' – 2500'	4	4
2501' and greater	5	5

All material placed on structures less than or equal to 500 feet in length shall be included as part of a standard lot as follows:

TABLE 4.06-5A: Testing requirement for Density Lots \geq 500 Tons

Lot Type	No. of Mat Cores		No. of Joint Cores		Target Lot Size (Tons)
Lot Without Bridge ⁽¹⁾	4		4		2000
Lot With Bridge(s) ⁽¹⁾⁽²⁾	4 plus	1 per structure ($\leq 300'$)	4 plus	1 per structure ($\leq 300'$)	2000
		2 per structure (301' – 500')		2 per structure (301' – 500')	

TABLE 4.06-5B: Testing requirement for Density Lots $<$ 500 Tons

Lot Type	No. of Mat Cores	No. of Joint Cores	Lot Size (Tons)
Lot Without Bridge ⁽¹⁾	3	3	1 per lift
Lot With Bridge(s) ⁽¹⁾⁽²⁾	3	3	1 per lift

Notes:

⁽¹⁾ The number of “Required Paver Passes for Full Width” shall be used to determine the sub-lot sizes within the lot. The number of paver passes for full width is determined by the contractor.

⁽²⁾ If a non-bridge mat or joint core location randomly falls on a structure, the core is to be obtained on the structure in addition to the core(s) required on the structure.

A density lot will be complete when the full designed paving width of the established lot length has been completed and shall include all longitudinal joints that exist between the curb lines regardless of date(s) paved. Quantity of material placed on structures less than or equal to 500 feet long is inclusive of the standard lot. Prior to paving, the total length of the project to be paved shall be split up into lots that contain approximately 2000 tons each. Areas such as highway ramps may be combined to create one lot. In general, combined areas should be set up to target a 2000 ton lot size. One adjustment will apply for each lot. The tons shall be determined using the yield calculation in Article 4.06.04. The last lot shall be the difference between the total payable tons for the project and the sum of the previous lots.

After the compaction process has been completed, the material shall be allowed to cool sufficiently to allow the cutting and removal of the core without damage. The Contractor shall core to a depth that allows extraction so that the uppermost layer being tested for density will not be affected.

A mat core shall not be taken any closer than one foot from the edge of a paver pass. If a random number locates a core less than one foot from any edge, locate the core so that the sample is one foot from the edge.

Method I, Notched Wedge Joint cores shall be taken so that the center of the core is 5 inches from the visible joint on the hot mat side. Refer to Figure 4.06-5.

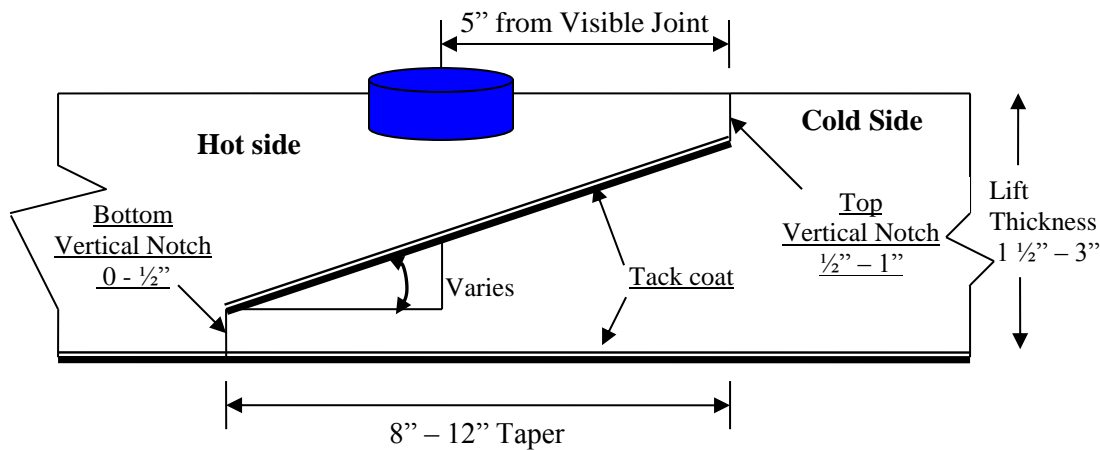


FIGURE 4.06-5: Notched Wedge Joint Cores

When Method III Butt Joint is utilized, cores shall be taken from the hot side so the edge of the core is within 1 inch of the longitudinal joint.

All cores must be cut within 5 calendar days of placement. Any core that is damaged or obviously defective while being obtained will be replaced with a new core from a location within 2 feet measured in a longitudinal direction.

Each core hole shall be filled within four hours upon core extraction. Prior to being filled, the hole shall be prepared by removing any free water and applying tack coat using a brush or other means to uniformly cover the cut surface. The core hole shall be filled using a bituminous concrete mixture at a minimum temperature of 240°F containing the same or smaller nominal maximum aggregate size and compacted with a hand compactor or other mechanical means to the maximum compaction possible. The bituminous concrete fill shall be compacted to 1/8 inch above the finished pavement.

11. Acceptance Inspection, Sampling and Testing: Inspection, sampling, and testing to be used by the Engineer shall be performed at the minimum frequency specified in Section M.04 and stated herein.

Sampling for acceptance shall be established using ASTM D 3665, or a statistically based procedure of random sampling approved by the Engineer.

Plant Material Acceptance: The Contractor shall provide the required acceptance sampling, testing and inspection during all phases of the work in accordance with Section M.04. The Department will perform verification testing on the Contractor's acceptance test results. Should binder content, theoretical maximum density (Gmm), or air void results exceed the specified tolerances in the Department's current QA Program for Materials, Acceptance and Assurance Testing Policies and Procedures, the Department will investigate to determine an assignable cause. Contractor test results for a subject lot or sub lot may be replaced with the Department's

results for the purpose of assessing adjustments. The verification procedure is included in the Department's current QA Program for Materials.

Density Acceptance: The Engineer will perform all acceptance testing on the cores in accordance with AASHTO T 331.

12. Density Dispute Resolution Process: The Contractor and Engineer will work in partnership to avoid potential conflicts and to resolve any differences that may arise during quality control or acceptance testing for density. Both parties will review their sampling and testing procedures and results and share their findings. If the Contractor disputes the Engineer's test results, the Contractor must submit in writing a request to initiate the Dispute Resolution Process within 7 calendar days of the notification of the test results. No request for dispute resolution will be allowed unless the Contractor provides quality control results within the timeframe described in Sub article 4.06.03-9 supporting its position. No request for Dispute Resolution will be allowed for a Density Lot in which any core was not taken within the required 5 calendar days of placement. Should the dispute not be resolved through evaluation of existing testing data or procedures, the Engineer may authorize the Contractor to obtain a new set of core samples per disputed lot. The core samples must be extracted no later than 14 calendar days from the date of Engineer's authorization.

The number and type (mat, joint, or structure) of the cores taken for dispute resolution must reflect the number and type of the cores taken for acceptance. The location of each core shall be randomly located within the respective original sub lot. All such core samples shall be extracted and filled using the procedure outlined in Article 4.06.03. The results from the dispute resolution cores shall be added to the results from the acceptance cores and averaged for determining the final in-place density value.

13. Corrective Work Procedures: Any portion of the completed pavement that does not meet the requirements of the specification shall be corrected at the expense of the Contractor. Any corrective courses placed as the final wearing surface shall match the specified lift thickness after compaction.

If pavement placed by the Contractor does not meet the specifications, and the Engineer requires its replacement or correction, the Contractor shall:

- a) Propose a corrective procedure to the Engineer for review and approval prior to any corrective work commencing. The proposal shall include:
 - Limits of pavement to be replaced or corrected, indicating stationing or other landmarks that are readily distinguishable.
 - Proposed work schedule.
 - Construction method and sequence of operations.
 - Methods of maintenance and protection of traffic.
 - Material sources.
 - Names and telephone numbers of supervising personnel.

- b) Perform all corrective work in accordance with the Contract and the approved corrective procedure.

14. Protection of the Work: The Contractor shall protect all sections of the newly finished pavement from damage that may occur as a result of the Contractor's operations for the duration of the Project. Prior to the Engineer's authorization to open the pavement to traffic, the Contractor is responsible to protect the pavement from damage.

15. Cut Bituminous Concrete Pavement: Work under this item shall consist of making a straight-line cut in the bituminous concrete pavement to the lines delineated on the plans or as directed by the Engineer. The cut shall provide a straight, clean, vertical face with no cracking, tearing or breakage along the cut edge.

4.06.04—Method of Measurement:

1. HMA S* or PMA S*: The quantity of bituminous concrete measured for payment will be determined by the documented net weight in tons accepted by the Engineer in accordance with this specification and Section M.04.

2. Adjustments: Adjustments may be applied to bituminous concrete quantities and will be measured for payment using the following formulas:

Yield Factor for Adjustment Calculation = 0.0575 Tons/SY/inch

Actual Area = [(Measured Length (ft)) x (Avg. of width measurements (ft))]

Actual Thickness (t) = Total tons delivered / [Actual Area (SY) x 0.0575 Tons/SY/inch]

- a) Area: If the average width exceeds the allowable tolerance, an adjustment will be made using the following formula. The tolerance for width is equal to the specified thickness (in.) of the lift being placed.

Tons Adjusted for Area (T_A) = $[(L \times W_{adj})/9] \times (t) \times 0.0575 \text{ Tons/SY/inch} = (-) \text{ Tons}$

Where: L = Length (ft)

(t) = Actual thickness (inches)

$W_{adj} = (\text{Designed width (ft)} + \text{tolerance} / 12) - \text{Measured Width}$

- b) Thickness: If the actual thickness is less than the allowable tolerance, the Contractor shall submit a repair procedure to the Engineer for approval. If the actual thickness exceeds the allowable tolerance, an adjustment will be made using the following formula:

Tons Adjusted for Thickness (T_T) = $A \times t_{adj} \times 0.0575 = (-) \text{ Tons}$

Where: $A = \text{Area} = \{ [L \times (\text{Designed width} + \text{tolerance (lift thickness)/12})] / 9 \}$
 $t_{\text{adj}} = \text{Adjusted thickness} = [(Dt + \text{tolerance}) - \text{Actual thickness}]$
 $Dt = \text{Designed thickness (inches)}$

- c) **Weight:** If the quantity of bituminous concrete representing the mixture delivered to the project is in excess of the allowable gross vehicle weight (GVW) for each vehicle, an adjustment will be made using the following formula:

Tons Adjusted for Weight (T_w) = GVW – DGW = (-) Tons

Where: DGW = Delivered gross weight as shown on the delivery ticket or measured on a certified scale.

- d) **Mixture Adjustment:** The quantity of bituminous concrete representing the production lot will be adjusted based on test results and values listed in Tables 4.06-6 and 4.06-7, . The Department's Division of Material Testing will calculate the daily adjustment value for T_{SD} .

The adjustment values in Table 4.06-6 and 4.06-7 shall be calculated for each sub lot based on the Air Void and Liquid Binder Content test results for that sub lot. The total adjustment for each day's production (lot) will be computed using tables and the following formulas:

Tons Adjusted for Superpave Design (T_{SD}) = [(AdjAV_t + AdjPB_t) / 100] X Tons

Percent Adjustment for Air Voids = AdjAV_t = [AdjAV₁ + AdjAV₂ + AdjAV_i + ... + AdjAV_n] / n

Where: AdjAV_t = Total percent air void adjustment value for the lot
 AdjAV_i = Adjustment value from Table 4.06-7 resulting from each sub lot or the average of the adjustment values resulting from multiple tests within a sub lot, as approved by the Engineer.
 n = number of sub lots based on Table M.04.03-1

TABLE 4.06-6: Adjustment Values for Air Voids

Adjustment Value (AdjAV _i) (%)	S0.25, S0.375, S0.5, S1 Air Voids (AV)
+2.5	3.8 - 4.2
+3.125*(AV-3)	3.0 - 3.7
-3.125*(AV-5)	4.3 - 5.0
20*(AV-3)	2.3 - 2.9
-20*(AV-5)	5.1 - 5.7
-20.0	≤ 2.2 or ≥ 5.8

Positive air void adjustment values will not be calculated for any test that fails to meet gradation or binder content tolerances of the JMF in Table M.04.03– 5.

Percent Adjustment for Liquid Binder = $\text{AdjPB}_t = [(\text{AdjPB}_1 + \text{AdjPB}_2 + \text{AdjPB}_i + \dots + \text{AdjPB}_n)] / n$

Where: AdjPB_t = Total percent liquid binder adjustment value for the lot

AdjPB_i = Adjustment value from Table 4.06-7 resulting from each sub lot

n = number of binder tests in a production lot

TABLE 4.06-7: Adjustment Values for Binder Content

Adjustment Value (AdjAV_i) (%)	<u>S0.25, S0.375, S0.5, S1</u> Pb (refer to Table M.04.02-5)
0.0	Equal to or above the min. liquid content
- 10.0	Below the min. liquid content

- e) Density Adjustment: The quantity of bituminous concrete measured for payment in a lift of pavement specified to be 1½ inches or greater may be adjusted for density. Separate density adjustments will be made for each lot and will not be combined to establish one density adjustment. If either the Mat or Joint adjustment value is “remove and replace”, the density lot shall be removed and replaced (curb to curb).

No positive adjustment will be applied to a Density Lot in which any core was not taken within the required 5 calendar days of placement.

Tons Adjusted for Density (T_D) = $[(\text{PA}_M \times .50) + (\text{PA}_J \times .50)] / 100] \times \text{Density Lot Tons}$

Where: T_D = Total tons adjusted for density for each lot

PA_M = Mat density percent adjustment from Table 4.06-9

PA_J = Joint density percent adjustment from Table 4.06-10

TABLE 4.06-9: Adjustment Values for Pavement Mat density

Average Core Result Percent Mat Density	Percent Adjustment (Bridge and Non-Bridge) ⁽¹⁾⁽²⁾
97.1 - 100	-1.667*(ACRPD-98.5)
94.5 – 97.0	+2.5
93.5 – 94.4	+2.5*(ACRPD-93.5)
92.0 – 93.4	0
90.0 – 91.9	-5*(92-ACRPD)
88.0 – 89.9	-10*(91-ACRPD)
87.0 – 87.9	-30
86.9 or less	Remove and Replace (curb to curb)

TABLE 4.06-10: Adjustment Values for Pavement Joint Density

Average Core Result Percent Joint Density	Percent Adjustment (Bridge and Non-Bridge) ⁽¹⁾⁽²⁾
97.1 – 100	-1.667*(ACRPD-98.5)
93.5 – 97.0	+2.5
92.0 – 93.4	+1.667*(ACRPD-92)
91.0 – 91.9	0
89.0 – 90.9	-7.5*(91-ACRPD)
88.0 – 88.9	-15*(90-ACRPD)
87.0 – 87.9	-30
86.9 or less	Remove and Replace (curb to curb)

⁽¹⁾ ACRPD = Average Core Result Percent Density

⁽²⁾ All Percent Adjustments to be rounded to the second decimal place. For example, 1.667 is to be rounded to 1.67.

3. Transitions for Roadway Surface: The installation of permanent transitions shall be measured under the appropriate item used in the formation of the transition.

The quantity of material used for the installation of temporary transitions shall be measured for payment under the appropriate item used in the formation of the transition. The installation and removal of a bond breaker, and the removal and disposal of any temporary transition formed by milling or with bituminous concrete pavement is not measured for payment.

4. Cut Bituminous Concrete Pavement: The quantity of bituminous concrete pavement cut will be measured in accordance with Article 2.02.04.

5. Material for Tack Coat: The quantity of tack coat will be measured for payment by the number of gallons furnished and applied on the Project and approved by the Engineer. No tack coat material shall be included that is placed in excess of the tolerance described in Article 4.06.03.

Method of Measurement:

- a. Container Method- Material furnished in a container will be measured to the nearest ½ gallon. The volume will be determined by either measuring the volume in the original container by a method approved by the Engineer or using a separate graduated container capable of measuring the volume to the nearest ½ gallon. The container in which the material is furnished must include the description of material, including lot number or batch number and manufacturer or product source.
- b. Truck Method- The Engineer will establish a weight per gallon of the tack coat based on the density at 60°F for the material furnished. The number of gallons furnished will be determined by weighing the material on scales furnished by and at the expense of the Contractor, or from the automated metering system on the delivery vehicle.

6. Material Transfer Vehicle (MTV): The furnishing and use of a MTV will be measured separately for payment based on the actual number of surface course tons delivered to a paver using the MTV.

4.06.05—Basis of Payment:

1. HMA S* or PMA S*: The furnishing and placing of bituminous concrete will be paid for at the Contract unit price per ton for “HMA S*” or “PMA S*”.

- All costs associated with providing illumination of the work area are included in the general cost of the work.
- All costs associated with cleaning the surface to be paved, including mechanical sweeping, are included in the general cost of the work. All costs associated with constructing longitudinal joints are included in the general cost of the work.
- All costs associated with obtaining cores for acceptance testing and dispute resolution are included in the general cost of the work.

2. Bituminous Concrete Adjustment Costs: The adjustment will be calculated using the formulas shown below if all of the measured adjustments in Article 4.06.04 are not equal to zero. A positive or negative adjustment will be applied to monies due the Contractor.

Production Lot: $[T_T + T_A + T_W + (T_{MD} \text{ or } T_{SD})] \times \text{Unit Price} = \text{Est. (P)}$

Density Lot: $T_D \times \text{Unit Price} = \text{Est. (D)}$

Where: Unit Price = Contract unit price per ton per type of mixture

T_* = Total tons of each adjustment calculated in Article 4.06.04

Est. () = Pay Unit represented in dollars representing incentive or disincentive.

The Bituminous Concrete Adjustment Cost item if included in the bid proposal or estimate is not to be altered in any manner by the Contractor. If the Contractor should alter the amount shown, the altered figure will be disregarded and the original estimated cost will be used for the Contract.

3. Transitions for Roadway Surface: The installation of permanent transitions shall be paid under the appropriate item used in the formation of the transition. The quantity of material used for the installation of temporary transitions shall be paid under the appropriate pay item used in the formation of the transition. The installation and removal of a bond breaker, and the removal and disposal of any temporary transition formed by milling or with bituminous concrete pavement is included in the general cost of the work.

4. The cutting of bituminous concrete pavement will be paid in accordance with Article 2.02.05.

5. Material for tack coat will be paid for at the Contract unit price per gallon for "Material for Tack Coat".

6. The Material Transfer Vehicle (MTV) will be paid at the Contract unit price per ton for a "Material Transfer Vehicle".

<u>Pay Item*</u>	<u>Pay Unit*</u>
HMA S*	ton
PMA S*	ton
Bituminous Concrete Adjustment Cost	est.
Material for Tack Coat	gal.
Material Transfer Vehicle	ton

*For contracts administered by the State of Connecticut, Department of Administrative Services, the pay items and pay units are as shown in contract award price schedule.

SECTION M.04 BITUMINOUS CONCRETE

Section M.04 is being deleted in its entirety and replaced with the following:

M.04.01—Bituminous Concrete Materials and Facilities

M.04.02—Mix Design and Job Mix Formula (JMF)

M.04.03—Production Requirements

M.04.01—Bituminous Concrete Materials and Facilities: Each source of material, and facility or plant used to produce and test bituminous concrete must be qualified on an annual basis by the Engineer. Test Procedures and Specifications referenced herein are in accordance with the latest AASHTO and ASTM Standard Test Procedures and Specifications. Such references when noted with an (M) have been modified by the Engineer and are detailed in Table M.04.03-7.

The Contractor shall submit to the Engineer all sources of coarse aggregate, fine aggregate, mineral filler, PG binder, and if applicable any additives such as but not limited to anti-strip, warm mix, and polymer modifiers. The Contractor shall submit a Safety Data Sheet (SDS) for each grade of binder, and additive to be used on the Project. The Contractor shall not change any material sources without prior approval of the Engineer.

An adequate quantity of each size aggregate, mineral filler, bitumen, and additives, shall be maintained at the bituminous concrete plant site at all times while the plant is in operation to ensure that the plant can consistently produce bituminous concrete mixtures that meet the job mix formula (JMF) as specified in Article M.04.02. The quantity of such material shall be reviewed by the Engineer on an individual plant basis and is dependent upon the plant's daily production capacity. A total quantity of any material on site that amounts to less than one day's production capacity may be cause for the job mix formula to be rejected.

1. Coarse Aggregate:

- a. **Requirements:** The coarse aggregate shall consist of clean, hard, tough, durable fragments of crushed stone or crushed gravel of uniform quality. Aggregates from multiple sources of supply must not be mixed or stored in the same stockpile.
- b. **Basis of Approval:** The request for approval of the source of supply shall include a washed sieve analysis in accordance with AASHTO T 27. The G_{sa}, G_{sb}, and P_{w_a} shall be determined in accordance with AASHTO T 85. The coarse aggregate must not contain more than 1% crusher dust, sand, soft disintegrated pieces, mud, dirt, organic and other injurious materials. When tested for abrasion using AASHTO T 96, the aggregate loss must not exceed 40%. When tested for soundness using AASHTO T 104 with a magnesium sulfate solution, the coarse aggregate must not have a loss exceeding 10% at the end of 5 cycles.

For all bituminous mixtures, materials shall also meet the coarse aggregate angularity criteria as specified in Tables M.04.02-2 thru M.04.02-4 for blended aggregates retained

on the #4 sieve when tested according to ASTM D 5821. The amount of aggregate particles of the coarse aggregate blend retained on the #4 sieve that are flat and elongated shall be determined in accordance with ASTM D 4791 and shall not exceed 10% by weight when tested to a 5:1 ratio, as shown in Tables M.04.02-2 thru M.04.02-4.

2. Fine Aggregate:

- a. **Requirements:** The fine aggregate from each source quarry/pit deposit shall consist of clean, hard, tough, rough-surfaced and angular grains of natural sand; manufactured sand prepared from washed stone screenings; stone screenings, slag or gravel; or combinations thereof, after mechanical screening or manufactured by a process approved by the Engineer. The Contractor is prohibited from mixing two or more sources of fine aggregate on the ground for the purpose of feeding into a plant.

All fine aggregate shall meet the listed criteria shown in items #1 thru #7 of Table M.04.01-1. Table M.04.01-1 indicates the quality tests and criteria required for all fine aggregate sources. Individually approved sources of supply shall not be mixed or stored in the same stockpile. The fine aggregates must be free from injurious amounts of clay, loam, and other deleterious materials.

For Superpave mixtures, in addition to the above requirements, the fine aggregate angularity shall be determined by testing the materials passing the #8 sieve in accordance with AASHTO T 304, Method A. Qualification shall be based on the criteria listed in Tables M.04.02-2 thru M.04.02-4. The fine aggregate shall also be tested for clay content as a percentage contained in materials finer than the #8 sieve in accordance with AASHTO T 176.

TABLE M.04.01-1: Fine Aggregate Criteria by Pit/Quarry Source

Item	Title	AASHTO Protocol(s)	Criteria
1	Grading	T 27 & T 11	100% Passing 3/8 inch 95% Passing the #4 min.
2	Absorption	T 84	3% maximum
3	Plasticity limits	T 90	0 or not detectable
4	L.A. Wear	T 96	50% maximum(fine agg. particle size # 8 and above)
5	Soundness by Magnesium Sulfate	T 104	20% maximum @ 5 cycles
6	Clay Lumps and Friable Particles	T 112	3% maximum
7	Deleterious Material	As determined by the Engineer	Organic or inorganic calcite, hematite, shale, clay or clay lumps, friable materials, coal-lignite, shells, loam, mica, clinkers, or organic matter (wood, etc). -Shall not contain more than 3% by mass of any individual listed constituent and not more than 5% by mass in total of all listed constituents.
8	Petrographic Analysis	ASTM C 295	Terms defined in Section M.04.01-2c.

b. Basis of Approval: A Quality Control Plan for Fine Aggregate (QCPFA) provided by the Contractor shall be submitted for review and approval for each new source documenting how conformance to Items 1 through 7 as shown in Table M.04.01-1 is monitored. The QCPFA must be resubmitted any time the process, location or manner of how the fine aggregate (FA) is manufactured changes, or as requested by the Engineer. The QCPFA must include the locations and manufacturing processing methods. The QCPFA for any source may be suspended by the Engineer due to the production of inconsistent material.

The Contractor shall submit all test results to the Engineer for review. The Contractor shall also include a washed sieve analysis in accordance with AASHTO T 27/T 11. Any fine aggregate component or final combined product shall have 100% passing the 3/8 inch sieve and a minimum of 95% passing the # 4. The G_{sa}, G_{sb}, and P_{wa} shall be determined in accordance with AASHTO T 84.

The Contractor will be notified by the Engineer if any qualified source of supply fails any portion of Table M.04.01-1. One retest will be allowed for the Contractor to make corrections and/or changes to the process. If, upon retest, the material does not meet the requirements of items 1-7, additional testing will be required in accordance with item 8.

The Contractor may provide a Petrographic analysis of the material performed by a third party acceptable to the Engineer at its' own expense. The Contractor shall submit the results of the analysis with recommended changes to the manufacturing process to the Engineer. The Contractor shall submit fine aggregate samples for testing by the Engineer after the recommended changes have been made.

The Contractor may request the use of such fine aggregate on select project(s) for certain applications of bituminous concrete pavement. Such material will be monitored for a period no less than 48 months, at no cost to the State. Terms of any evaluation and suitable application will be determined by the Engineer.

3. Mineral Filler:

- a. Requirements: Mineral filler shall consist of finely divided mineral matter such as rock dust, including limestone dust, slag dust, hydrated lime, hydraulic cement, or other accepted mineral matter. At the time of use it shall be freely flowing and devoid of agglomerations. Mineral filler shall be introduced and controlled at all times during production in a manner acceptable to the Engineer.
- b. Basis of Approval: The request for approval of the source of supply shall include the location, manufacturing process, handling and storage methods for the material. Mineral filler shall conform to the requirements of AASHTO M 17.

4. Performance Graded Asphalt Binder:

a. General:

- i Liquid PG binders shall be uniformly mixed and blended and be free of contaminants such as fuel oils and other solvents. Binders shall be properly heated and stored to prevent damage or separation.
- ii. The blending at mixing plants of PG binder from different suppliers is strictly prohibited. Contractors who blend PG binders will be classified as a supplier and will be required to certify the binder in accordance with AASHTO R 26(M). The binder shall meet the requirements of AASHTO M 332 and shall be graded or verified in accordance with AASHTO R 29. The Contractor shall submit a Certified Test Report and bill of lading representing each delivery in accordance with AASHTO R 26(M). The Certified Test Report must also indicate the binder specific gravity at 77°F; rotational viscosity at 275°F and 329°F and the mixing and compaction viscosity-temperature chart for each shipment.
- iii. The Contractor shall submit the name(s) of personnel responsible for receipt, inspection, and record keeping of PG binder materials. Contractor plant personnel shall document specific storage tank(s) where binder will be transferred and stored until used, and provide binder samples to the Engineer upon request. The person(s) shall assure that each shipment (tanker truck) is accompanied by a statement certifying that the transport vehicle was inspected before loading and was found acceptable for the material shipped and that the binder will be free of contamination from any residual material, along with two (2) copies of the bill of lading.
- iv. Basis of Approval: The request for approval of the source of supply shall list the location where the material will be manufactured, and the handling and storage methods, along with necessary certification in accordance with AASHTO R 26(M). Only suppliers/refineries that have an approved "Quality Control Plan for Performance Graded Binders" formatted in accordance with AASHTO R 26(M) will be allowed to supply PG binders to Department projects.

b. Neat Performance Grade (PG) Binder:

- i. PG binder shall be classified by the supplier as a "Neat" binder for each lot and be so labeled on each bill of lading. Neat PG binders shall be free from modification with: fillers, extenders, reinforcing agents, adhesion promoters, thermoplastic polymers, acid modification and other additives such as re-refined motor oil, and shall indicate such information on each bill of lading and certified test report.
- ii. The asphalt binder shall be PG 64S-22.

c. Modified Performance Grade (PG) Binder:

Unless otherwise noted, the asphalt binder shall be Performance Grade PG 64E-22 asphalt modified solely with a Styrene-Butadiene-Styrene (SBS) polymer. The polymer modifier shall be added at either the refinery or terminal and delivered to the bituminous concrete production facility as homogenous blend. The stability of the

modified binder shall be verified in accordance with ASTM D7173 using the Dynamic Shear Rheometer (DSR). The DSR $G^*/\sin(\delta)$ results from the top and bottom sections of the ASTM D7173 test shall not differ by more than 10%. The results of ASTM D7173 shall be included on the Certified Test Report. The binder shall meet the requirements of AASHTO M 332 (including Appendix X1) and AASHTO R 29.

d. Warm Mix Additive or Technology:

- i. The warm mix additive or technology must be listed on the NEAUPG Qualified Warm Mix Asphalt (WMA) Technologies List at the time of bid, which may be accessed online at http://www.neaupg.uconn.edu/wma_info.html.
- ii. The warm mix additive shall be blended with the asphalt binder in accordance with the manufacturer's recommendations.
- iii. The blended binder shall meet the requirements of AASHTO M 332 and shall be graded or verified in accordance with AASHTO R 29 for the specified binder grade. The Contractor shall submit a Certified Test Report showing the results of the testing demonstrating the binder grade. In addition, it must include the grade of the virgin binder, the brand name of the warm mix additive, the manufacturer's suggested rate for the WMA additive, the water injection rate (when applicable) and the WMA Technology manufacturer's recommended mixing and compaction temperature ranges.

5. Emulsified Asphalts:

a. General:

- i. Emulsified asphalts shall be homogeneous and be free of contaminants such as fuel oils and other solvents. Emulsions shall be properly stored to prevent damage or separation.
- ii. The blending at mixing plants of emulsified asphalts from different suppliers is strictly prohibited. Contractors who blend emulsified asphalts will be classified as a supplier and will be required to certify the emulsion in accordance with AASHTO PP 71. The emulsified asphalt shall meet the requirements of AASHTO M 140(M) or AASHTO M 208 as applicable.

b. Supplier Approval:

- i. The request for approval of the source of supply shall list the location where the material is manufactured, the handling and storage methods, and certifications in accordance with AASHTO PP 71. Only suppliers that have an approved "Quality Control Plan for Emulsified Asphalt" formatted in accordance with AASHTO PP 71 will be allowed to supply emulsified asphalt to Department projects.
- ii. The supplier shall submit to the Division Chief a Certified Test Report representing each lot in accordance with AASHTO PP 71. The Certified Test Report shall include test results for each specified requirement for the grade delivered and shall also indicate the density at 60°F. Additionally, once a month one split sample for each emulsified asphalt grade shall be submitted.

c. Basis of Approval

- i. Each shipment of emulsified asphalt delivered to the project site shall be accompanied with the corresponding SDS and Certified Test Report listing Saybolt viscosity, residue by evaporation, penetration of residue, and weight per gallon at 60°F.
- ii. Anionic emulsified asphalts shall conform to the requirements of AASHTO M-140(M). Materials used for tack coat shall not be diluted and meet grade RS-1 or RS-1H. When ambient temperatures are 80°F and rising, grade SS-1 or SS-1H may be substituted if permitted by the Engineer.
- iii. Cationic emulsified asphalt shall conform to the requirements of AASHTO M-208. Materials used for tack coat shall not be diluted and meet grade CRS-1. The settlement and demulsibility test will not be performed unless deemed necessary by the Engineer. When ambient temperatures are 80°F and rising, grade CSS-1 or CSS-1h may be substituted if permitted by the Engineer.

6. Reclaimed Asphalt Pavement (RAP):

- a. Requirements: RAP shall consist of asphalt pavement constructed with asphalt and aggregate reclaimed by cold milling or other removal techniques approved by the Engineer. For bituminous concrete mixtures containing RAP, the Contractor shall submit a JMF in accordance with Article M.04.02 to the Engineer for review.
- b. Basis of Approval: The RAP material will be accepted on the basis of one of the following criteria:
 - i. When the source of all RAP material is from pavements previously constructed on Department projects, the Contractor shall provide a materials certificate listing the detailed locations and lengths of those pavements and that the RAP is only from those locations listed.
 - ii. When the RAP material source or quality is not known, the Contractor shall test the material and provide the following information along with a request for approval to the Engineer at least 30 calendar days prior to the start of the paving operation. The request shall include a material certificate stating that the RAP consists of aggregates that meet the specification requirements of sub articles M.04.01-1 through 3 and that the binder in the RAP is substantially free of solvents, tars and other contaminants. The Contractor is prohibited from using unapproved material on Department projects and shall take necessary action to prevent contamination of approved RAP stockpiles. Stockpiles of unapproved material shall remain separate from all other RAP materials at all times. The request for approval shall include the following:
 1. A 50-pound sample of the RAP to be incorporated into the recycled mixture.
 2. A 25-pound sample of the extracted aggregate from the RAP.
 3. A statement that RAP material has been crushed to 100% passing the ½ inch sieve and remains free from contaminants such as joint compound, wood, plastic, and metals.

7. Crushed Recycled Container Glass (CRCG):

- a. Requirements: The Contractor may propose to use clean and environmentally-acceptable CRCG in an amount not greater than 5% by weight of total aggregate.
- b. Basis of Approval: The Contractor shall submit to the Engineer a request to use CRCG. The request shall state that the CRCG contains no more than 1% by weight of contaminants such as paper, plastic and metal and conform to the following gradation:

CRCG Grading Requirements	
<u>Sieve Size</u>	<u>Percent Passing</u>
3/8-inch	100
No. 4	35-100
No. 200	0.0-10.0

8. Joint Seal Material:

- a. Requirements: Joint seal material shall be a hot-poured rubber compound intended for use in sealing joints and cracks in bituminous concrete pavements. Joint seal material must meet the requirements of ASTM D 6690 – Type 2.

9. Recycled Asphalt Shingles (RAS)

- a. Requirements: RAS shall consist of processed asphalt roofing shingles from post-consumer asphalt shingles or from manufactured shingle waste. The RAS material under consideration for use in bituminous concrete mixtures must be certified as being asbestos free and shall be entirely free of whole, intact nails. The RAS material shall meet the requirements of AASHTO MP 23.

The producer shall test the RAS material to determine the asphalt content and the gradation of the RAS material. The producer shall take necessary action to prevent contamination of RAS stockpiles.

10. Plant Requirements:

- a. Mixing Plant and Machinery: The mixing plant used in the preparation of the bituminous concrete shall comply with AASHTO M 156/ASTM D 995 for a Batch Plant or a Drum Dryer Mixer Plant, and be approved by the Engineer.

- b. Storage Silos: For all mixes, the Contractor may use silos for short-term storage of Superpave mixtures with prior notification and approval of the Engineer. A silo must have heated cones and an unheated silo cylinder if it does not contain a separate internal heating system. Prior approval must be obtained for storage times greater than those indicated. When multiple silos are filled, the Contractor shall discharge one silo at a time. Simultaneous discharge of multiple silos is not permitted.

<u>Type of silo cylinder</u>	<u>Maximum storage time for all classes (hr)</u>	
	HMA	WMA/PMA
Open Surge	4	Mfg Recommendations
Unheated – Non-insulated	8	Mfg Recommendations
Unheated – Insulated	18	Mfg Recommendations
Heated – No inert gas	TBD by the Engineer	

- c. Documentation System: The mixing plant documentation system shall include equipment for accurately proportioning the components of the mixture by weight and in the proper order, controlling the cycle sequence and timing the mixing operations. Recording equipment shall monitor the batching sequence of each component of the mixture and produce a printed record of these operations on each delivery ticket, as specified herein. Material feed controls shall be automatically or manually adjustable to provide proportions within the tolerances listed below for any batch size.

An asterisk (*) shall be automatically printed next to any individual batch weight(s) exceeding the tolerances in ASTM D 995 section 8.7.3. The entire batching and mixing interlock cut-off circuits shall interrupt and stop the automatic batching operations when an error exceeding the acceptable tolerance occurs in proportioning.

There must be provisions so that scales are not manually adjusted during the printing process. In addition, the system shall be interlocked to allow printing only when the scale has come to a complete rest. A unique printed character (m) shall automatically be printed on the truck and batch plant printout when the automatic batching sequence is interrupted or switched to auto-manual or full manual during proportioning. For each day's production, each project shall be provided a clear, legible copy of these recordings on each delivery ticket.

- d. Aggregates: The Contractor shall ensure that aggregate stockpiles are managed to provide uniform gradation and particle shape, prevent segregation and cross contamination in a manner acceptable to the Engineer. For drum plants only, the Contractor shall determine the percent moisture content at a minimum, prior to production and half way through production.
- e. Mixture: The dry and wet mix times shall be sufficient to provide proper coating (minimum 95% as determined by AASHTO T 195(M)) of all particles with bitumen and produce a uniform mixture.

The Contractor shall make necessary adjustments to ensure all types of bituminous concrete mixtures contain no more than 0.5% moisture throughout when tested in accordance with AASHTO T 329.

- f. RAP: The Contractor shall indicate the percent of RAP, the moisture content (as a minimum determined twice daily prior to production and halfway through production), and the net dry weight of RAP added to the mixture on each delivery ticket. For each day of production, the production shall conform to the job mix formula and RAP percentage and no change shall be made without the prior approval of the Engineer.
- g. Asphalt Binder: The last day of every month, a binder log shall be submitted when the monthly production for the Department exceeds 5000 tons. Blending of PG binders from different suppliers or grades at the bituminous concrete production facility is strictly prohibited.
- h. Warm mix additive: For mechanically foamed WMA, the maximum water injection rate shall not exceed 2.0% water by total weight of binder and the water injection rate shall be constantly monitored during production.
- i. Field Laboratory: The Contractor shall furnish the Engineer an acceptable field laboratory at the production facility to test bituminous concrete mixtures during production. The field laboratory shall have a minimum of 300 square feet, have a potable water source and drainage in accordance with the CT Department of Public Health Drinking Water Division, and be equipped with all necessary testing equipment as well as with a PC, printer, and telephone with a dedicated hard-wired phone line. In addition, the PC shall have a high speed internet connection with a minimum upstream of 384 Kbps and a functioning web browser with unrestricted access to <https://ctmail.ct.gov>. This equipment shall be maintained in clean and good working order at all times and be made available for use by the Engineer.

The laboratory shall be equipped with a suitable heating system capable of maintaining a minimum temperature of 65°F. It shall be clean and free of all materials and equipment not associated with the laboratory. Windows shall be installed to provide sufficient light and ventilation. During summer months adequate cooling or ventilation must be provided so the indoor air temperature shall not exceed the ambient outdoor temperature. Light fixtures and outlets shall be installed at convenient locations, and a telephone shall be within audible range of the testing area. The laboratory shall be equipped with an adequate workbench that has a suitable length, width, and sampling tables, and be approved by the Engineer.

The field laboratory testing apparatus, supplies, and safety equipment shall be capable of performing all tests in their entirety that are referenced in AASHTO R 35, *Standard Practice for Superpave Volumetric Design for Hot-Mix Asphalt (HMA)* and AASHTO M 323, *Standard Specification for Superpave Volumetric Mix Design*. In addition, the quantity of all equipment and supplies necessary to perform the tests must be sufficient to

initiate and complete the number of tests identified in Table M.04.03-2 for the quantity of mixture produced at the facility on a daily basis. The Contractor shall ensure that the Laboratory is adequately supplied at all times during the course of the project with all necessary testing materials and equipment.

The Contractor shall maintain a list of laboratory equipment used in the acceptance testing processes including but not limited to, balances, scales, manometer/vacuum gauge, thermometers, gyratory compactor, clearly showing calibration and/or inspection dates, in accordance with AASHTO R 18. The Contractor shall notify the Engineer if any modifications are made to the equipment within the field laboratory. The Contractor shall take immediate action to replace, repair, and/or recalibrate any piece of equipment that is out of calibration, malfunctioning, or not in operation.

M.04.02—Mix Design and Job Mix Formula (JMF)

1. Curb Mix:

- a. Requirements: When curb mix is specified, the Contractor shall develop a bituminous concrete mix design that includes a JMF consisting of target values for gradation, binder content and air voids as shown in Table M.04.02-1. The Contractor may use RAP in 5% increments up to a maximum of 30% provided a new JMF is accepted by the Engineer.
- b. Basis of Approval: The Contractor shall submit to the Engineer a request for approval of the JMF annually in accordance with one of the methods described herein. Prior to the start of any paving operations, the JMF must be accepted by the Engineer, and the Contractor must demonstrate the ability to meet the accepted JMF. Additionally, the fraction of material retained between any two consecutive sieves shall not be less than 4%.

The Contractor shall test the mixture for compliance with the submitted JMF and Table M.04.02-1. The maximum theoretical density (Gmm) will be determined by AASHTO T 209. If the mixture does not meet the requirements, the JMF shall be adjusted within the ranges shown in Table M.04.02-1 until an acceptable mixture is produced.

An accepted JMF from the previous operating season may be acceptable to the Engineer provided that there are no changes in the sources of supply for the coarse aggregate, fine aggregate, recycled material (if applicable) and the plant operation had been consistently producing acceptable mixture.

The Contractor shall not change sources of supply after a JMF has been accepted. Before a new source of supply for materials is used, a new JMF shall be submitted to the Engineer for approval.

**TABLE M.04.02 – 1:
Master Ranges for Curb Mix Mixtures**

Notes: (a) Compaction Parameter 50gyration N_{des} . (b) The percent passing the #200 sieve shall not exceed the percentage of bituminous asphalt binder determined by AASHTO T 164 or AASHTO T 308.

Mix	Curb Mix	Production Tolerances from JMF target
Grade of PG Binder content %	PG 64S-22 6.5 - 9.0	0.4
Sieve Size		
# 200	3.0 – 8.0 (b)	2.0
# 50	10 - 30	4
# 30	20 - 40	5
# 8	40 - 70	6
# 4	65 - 87	7
1/4"		
3/8 "	95 - 100	8
1/2 "	100	8
3/4"		8
1"		
2"		
Additionally, the fraction of material retained between any two consecutive sieves shall not be less than 4%		
Mixture Temperature		
Binder	325°F maximum	
Aggregate	280-350° F	
Mixtures	265-325° F	
Mixture Properties		
VOIDS %	0 – 4.0 (a)	

2. Superpave Design Method – S0.25, S0.375, S0.5, and S1

- a. Requirements: The Contractor or its representative shall design and submit Superpave mix designs annually for approval. The design laboratory developing the mixes shall be approved by the Engineer. The mix design shall be based on the specified Equivalent Single-Axle Loads (ESAL). Each bituminous concrete mix type must meet the requirements shown in Tables M.04.02-2 thru Table M.04.02-5 and in accordance with AASHTO M 323 and AASHTO R 35. The mix design shall include the nominal maximum aggregate size and a JMF consisting of target values for gradation and bitumen content for each bituminous concrete mix type designated for the project.

The contractor shall provide test results with supporting documentation from an AASHTO Materials Reference Laboratory (AMRL) with the use of NETTCP Certified Technicians for the following tests:

1. Aggregate consensus properties for each type & level, as specified in Table M.04.02-3 and the specific gravity data.
2. Extracted aggregates from RAP aggregate, when applicable, consensus properties for each type & level, as specified in Table M.04.02-3 and the specific gravity data.
3. New mixes shall be tested in accordance with AASHTO T 283(M) *Standard Method of Test for Resistance of Compacted Hot-Mix Asphalt (HMA) to Moisture-Induced Damage*, (TSR). The compacted specimens may be fabricated at a bituminous concrete facility and then tested at an AMRL accredited facility.

The AASHTO T 283(M) test results, specimens, and corresponding JMF sheet (Form MAT-429s) shall be submitted by the Contractor for review.

In addition, minimum binder content values apply to all types of bituminous concrete mixtures, as stated in Table M.04.02-5. For mixtures containing RAP, the virgin production and the anticipated proportion of binder contributed by the RAP cannot be less than the total permitted binder content value for that type nor the JMF minimum binder content.

- i. Superpave Mixture (virgin): For bituminous concrete mixtures that contain no recycled material, the limits prescribed in Tables M.04.02-2 thru Table M.04.02-5 apply. The Contractor shall submit a JMF, on a form provided by the Engineer, with the individual fractions of the aggregate expressed as percentages of the total weight of the mix and the source(s) of all materials to the Engineer for approval. The JMF shall indicate the corrected target binder content and applicable binder correction factor (ignition oven or extractor) for each mix type by total weight of mix. The mineral filler (dust) shall be defined as that portion of blended mix that passes the #200 sieve by weight when tested in accordance with AASHTO T 30. The dust-to-effective asphalt (D/Pbe) ratio shall be between 0.6 and 1.2 by weight. The dry/wet mix times and hot bin proportions (batch plants only) for each type shall be included in the JMF.

The percentage of aggregate passing each sieve shall be plotted on a 0.45 power gradation chart and shall be submitted for all bituminous concrete mixtures. This chart shall delineate the percentage of material passing each test sieve size as defined by the JMF. The percentage of aggregate passing each standard sieve shall fall within the specified control points as shown in Tables M.04.02-2 thru Table M.04.02-5. A change in the JMF requires that a new chart be submitted.

- ii. Superpave Mixtures with RAP: Use of approved RAP may be allowed with the following conditions:
- RAP amounts up to 15% may be used with no binder grade modification.
 - RAP amounts up to 20% may be used provided a new JMF is approved by the Engineer. The JMF submittal shall include the grade of virgin binder added. The JMF shall be accompanied by a blending chart and supporting test results in accordance with AASHTO M 323 Appendix X1, or by test results that show the combined binder (recovered binder from the RAP, virgin binder at the mix design proportions, warm mix asphalt additive and any other modifier if used) meets the requirements of the specified binder grade.
 - Two representative samples of RAP shall be obtained. Each sample shall be split and one split sample shall be tested for binder content in accordance with AASHTO T 164 and the other in accordance AASHTO T 308.

Unless approved by the Engineer, RAP material shall not be used with any other recycling option.

- iii. Superpave Mixtures with RAS: Use of RAS may be allowed solely in HMA S1 mixtures with the following conditions:
- RAS amounts up to 3% may be used.
 - RAS total binder replacement up to 15% may be used with no binder grade modification.
 - RAS total binder replacement up to 20% may be used provided a new JMF is approved by the Engineer. The JMF submittal shall include the grade of virgin binder added. The JMF shall be accompanied by a blending chart and supporting test results in accordance to AASHTO M 323 appendix X1 or by test results that show the combined binder (recovered binder from the RAP, virgin binder at the mix design proportions, warm mix asphalt additive and any other modifier if used) meets the requirements of the specified binder grade.
 - Superpave Mixtures with RAS shall meet AASHTO PP 78 design considerations. The RAS asphalt binder availability factor (F) used in AASHTO PP 78 Equation 2 shall be 0.85.
- iv. Superpave Mixtures with CRCG: In addition to the requirements in M.04.02 – 2 a through c, for bituminous concrete mixtures that contain CRCG, the Contractor shall submit a materials certificate to the Engineer stating that the CRCG complies with requirements stated in Article M.04.01, as applicable. Additionally, 1% hydrated lime, or other accepted non-stripping agent, shall be added to all mixtures containing CRCG. CRCG material shall not be used with any other recycling option.

- b. Basis of Approval: On an annual basis, the Contractor shall submit to the Engineer any bituminous concrete mix design, and JMF anticipated for use on Department projects. Prior to the start of any paving operations, the mix design and JMF must be approved by the Engineer. Bituminous concrete mixture supplied to the project without an approved mix design and JMF will be rejected. The following information must be included in the mix design submittal:
- i. Gradation, consensus properties and specific gravities of the aggregate, RAP, and RAS.
 - ii. Average asphalt content of the RAP and RAS by AASHTO T 164.
 - iii. Source of RAP and RAS and percentage to be used.
 - iv. Warm mix Technology and manufacturer's recommended additive rate and tolerances.
 - v. TSR test report, and, if applicable, anti-strip manufacturer and recommended dosage rate.
 - vi. Mixing and compaction temperature ranges for the mix with and without the warm-mix technology incorporated.
 - vii. JMF ignition oven correction factor by AASHTO T 308.

The JMF shall be accepted if the Plant mixture and materials meet all criteria as specified in Tables M.04.02-2 thru Table M.04.02-5. If the mixture does not meet the requirements, the contractor shall adjust the JMF within the ranges shown in Tables M.04.02-2 thru Table M.04.02-5 until an acceptable mixture is produced. All equipment, tests, and computations shall conform to the latest AASHTO R 35 and AASHTO M 323.

Any JMF, once approved, shall only be acceptable for use when it is produced by the designated plant, it utilizes the same component aggregates and binder source, and it continues to meet all criteria as specified herein, and component aggregates are maintained within the tolerances shown in Table M.04.02-2.

The Contractor shall not change any component source of supply including consensus properties after a JMF has been accepted. Before a new source of materials is used, a revised JMF shall be submitted to the Engineer for approval. Any approved JMF applies only to the plant for which it was submitted. Only one mix with one JMF will be approved for production at any one time. Switching between approved JMF mixes with different component percentages or sources of supply is prohibited.

- c. Mix Status: Each facility will have each type of bituminous concrete mixture evaluated based on the previous year of production, for the next construction paving season, as determined by the Engineer. Based on the rating a type of mixture receives it will determine whether the mixture can be produced without the completion of a PPT. Ratings will be provided to each bituminous concrete producer annually prior to the beginning of the paving season.

The rating criteria are based on compliance with Air Voids and Voids in Mineral Aggregate (VMA) as indicated in Table M.04.03-3: *Superpave Master Range for Bituminous Concrete Mixture Production*, and are as follows:

Criteria A: Based on Air Voids. Percentage of acceptance results with passing air voids.

Criteria B: Based on Air Voids and VMA. The percentage of acceptance results with passing VMA, and the percentage of acceptance results with passing air voids, will be averaged.

The final rating assigned will be the lower of the rating obtained with Criteria A or Criteria B.

Ratings are defined as:

“A” – Approved:

A rating of “A” is assigned to each mixture type from a production facility with a current rating of 70% passing or greater.

“PPT” – Pre-Production Trial:

Rating assigned to each mixture type from a production facility when:

1. there are no passing acceptance production results submitted to the Department from the previous year;
2. there is a source change in one or more aggregate components from the JMF on record by more than 10% by weight;
3. there is a change in RAP percentage;
4. the mixture has a rating of less than 70% from the previous season;
5. a new JMF not previously submitted.

Bituminous concrete mixtures rated with a “PPT” cannot be shipped or used on Department projects. A passing “PPT” test shall be performed with NETTCP certified personnel on that type of mixture by the bituminous concrete producer and meet all specifications (Table M.04.02-2 Table M.04.02-5) before production shipment may be resumed.

Contractors that have mix types rated as “PPT” may use one of the following methods to change the rating to an “A.”

Option A: Schedule a day when a Department inspector can be at the facility to witness a passing “PPT” test or,

Option B: When the Contractor or their representative performs a “PPT” test without being witnessed by an inspector, the Contractor shall submit the test results and a split sample including 2 gyratory molds, 5,000 grams of boxed bituminous concrete for binder and gradation determination, and 5,000 grams of cooled loose bituminous concrete for Gmm determination for verification testing and approval. Passing verifications will designate the bituminous concrete type to

be on an “A” status. Failing verifications will require the contractor to submit additional trials.

Option C: When the Contractor or their representative performs a “PPT” test without being witnessed by a Department inspector, the Engineer may verify the mix in the Contractor’s laboratory. Passing verifications will designate the bituminous concrete type to be an “A” status. Failing verifications will require the Contractor to submit additional trials.

When Option (A) is used and the “PPT” test meets all specifications, the “PPT” test is considered a passing test and the rating for that mix is changed to “A”. When the “PPT” test is not witnessed, the “PPT” Option (B) or (C) procedure must be followed. If the “PPT” Option (B) procedure is followed, the mixtures along with the test results must be delivered to the Materials Testing Lab. The test results must meet the “C” tolerances established by the Engineer. The tolerance Table is included in the Department’s current QA Program for Materials, Acceptance and Assurance Testing Policies and Procedures.

“U” – No Acceptable Mix Design on File:

Rating assigned to a type of mixture that does not have a JMF submitted, or the JMF submitted has not been approved, or is incomplete. A mix design or JMF must be submitted annually seven (7) days prior in order to obtain an “A,” or “PPT” status for that mix. A “U” will be used only to designate the mix status until the mix design has been approved, and is accompanied with all supporting data as specified. Bituminous concrete mixtures rated with a “U” cannot be used on Department projects.

TABLE M.04.02– 2: Superpave Master Range for Bituminous Concrete Mixture Design Criteria

Notes: ⁽¹⁾ Minimum Pb as specified in Table M.04.02-5. ⁽²⁾ Voids in Mineral Aggregates shall be computed as specified in AASHTO R 35. ⁽³⁾ Control point range is also defined as the master range for that mix. ⁽⁴⁾ Dust is considered to be the percent of materials passing the #200 sieve. ⁽⁵⁾ For WMA, lower minimum aggregate temperature will require Engineer's approval. ⁽⁶⁾ For WMA and PMA, the mix temperature shall meet manufacturer's recommendations.								
	S0.25		S0.375		S0.5		S1	
Sieve	CONTROL POINTS ⁽³⁾		CONTROL POINTS ⁽³⁾		CONTROL POINTS ⁽³⁾		CONTROL POINTS ⁽³⁾	
inches	Min (%)	Max (%)	Min (%)	Max (%)	Min (%)	Max (%)	Min (%)	Max (%)
2.0	-	-	-	-	-	-	-	-
1.5	-	-	-	-	-	-	100	-
1.0	-	-	-	-	-	-	90	100
3/4	-	-	-	-	100	-	-	90
1/2	100	-	100	-	90	100	-	-
3/8	97	100	90	100	-	90	-	-
#4	-	90	-	90	-	-	-	-
#8	32	67	32	67	28	58	19	45
#16	-	-	-	-	-	-	-	-
#30	-	-	-	-	-	-	-	-
#50	-	-	-	-	-	-	-	-
#100	-	-	-	-	-	-	-	-
#200	2.0	10.0	2.0	10.0	2.0	10.0	1.0	7.0
Pb ⁽¹⁾	-	-	-	-	-	-	-	-
VMA ⁽²⁾ (%)	16.0 ± 1		16.0 ± 1		15.0 ± 1		13.0 ± 1	
VA (%)	4.0 ± 1		4.0 ± 1		4.0 ± 1		4.0 ± 1	
Gse	JMF value		JMF value		JMF value		JMF value	
Gmm	JMF ± 0.030		JMF ± 0.030		JMF ± 0.030		JMF ± 0.030	
Dust/Pbe ⁽⁴⁾	0.6 – 1.2		0.6 – 1.2		0.6 – 1.2		0.6 – 1.2	
Agg. Temp ⁽⁵⁾	280 – 350°F		280 – 350°F		280 – 350°F		280 – 350°F	
Mix Temp ⁽⁶⁾	265 – 325°F		265 – 325°F		265 – 325°F		265 – 325°F	
Design TSR	> 80%		> 80%		> 80%		> 80%	
T-283 Stripping	Minimal, as determined by the Engineer							

TABLE M.04.02–3: Superpave Master Range for Consensus Properties of Combined Aggregate Structures

Notes: (1) If less than 25 % of a given layer is within 4 inches of the anticipated top surface, the layer may be considered to be below 4 inches for mixture design purposes.					
Traffic Level	Design ESALs (80 kN)	Coarse Aggregate Angularity ⁽¹⁾ ASTM D 5821	Fine Aggregate Angularity ⁽⁷⁾ AASHTO T 304	Flat and Elongated Particles ASTM D 4791	Sand Equivalent AASHTO T 176
-----	(million)			> #4	-----
1*	< 0.3	55/- -	40	10	40
2	0.3 to < 3.0	75/- -	40	10	40
3	≥ 3.0	95/90	45	10	45
	Design ESALs are the anticipated project traffic level expected on the design lane, projected over a 20 year period, regardless of the actual expected design life of the roadway.	Criteria presented as minimum values. 95/90 denotes that a minimum of 95% of the coarse aggregate, by mass, shall have one fractured face and that a minimum of 90% shall have two fractured faces.	Criteria presented as minimum percent air voids in loosely compacted fine aggregate passing the #8 sieve.	Criteria presented as maximum Percent by mass of flat and elongated particles of materials retained on the #4 sieve, determined at 5:1 ratio.	Criteria presented as minimum values for fine aggregate passing the #8 sieve.

*** NOTE: Level 1 for use by Towns and Municipalities ONLY.**

TABLE M.04.02– 4: Superpave Master Range for Traffic Levels and Design Volumetric Properties

Traffic Level	Design ESALs	Number of Gyration by Superpave Gyratory Compactor			Percent Density of Gmm from HMA/WMA specimen			Voids Filled with Asphalt (VFA) Based on Nominal mix size – inch			
	(million)	Nini	Ndes	Nmax	Nini	Ndes	Nmax	0.25	0.375	0.5	1
1*	< 0.3	6	50	75	≤ 91.5	96.0	≤ 98.0	70 - 80	70 - 80	70 - 80	67 - 80
2	0.3 to < 3.0	7	75	115	≤ 90.5	96.0	≤ 98.0	65 - 78	65 - 78	65 - 78	65 - 78
3	≥ 3.0	8	100	160	≤ 90.0	96.0	≤ 98.0	73 – 76	73 - 76	65 - 75	65 - 75

*** NOTE: Level 1 for use by Towns and Municipalities ONLY.**

TABLE M.04.02– 5:
Superpave Minimum Binder Content by Mix Type and Level

Mix Type	Level	Binder Content Minimum ⁽¹⁾
S0.25	1*	5.6
S0.25	2	5.5
S0.25	3	5.4
S0.375	1*	5.6
S0.375	2	5.5
S0.375	3	5.4
S0.5	1*	5.0
S0.5	2	4.9
S0.5	3	4.8
S1	1*	4.6
S1	2	4.5
S1	3	4.4

*** NOTE: Level 1 for use by Towns and Municipalities ONLY.**

M.04.03— Production Requirements:

1. Standard Quality Control Plan (QCP) for Production:

The QCP for production shall describe the organization and procedures which the Contractor shall use to administer quality control. The QCP shall include the procedures used to control the production process, to determine when immediate changes to the processes are needed, and to implement the required changes. The QCP must detail the inspection, sampling and testing protocols to be used, and the frequency for each.

Control Chart(s) shall be developed and maintained for critical aspect(s) of the production process as determined by the Contractor. The control chart(s) shall identify the material property, applicable upper and lower control limits, and be updated with current test data. As a minimum, the following quality characteristics shall be included in the control charts: percent passing #4 sieve, percent passing #200 sieve, binder content, air voids, Gmm and VMA. The control chart(s) shall be used as part of the quality control system to document variability of the bituminous concrete production process. The control chart(s) shall be submitted to the Engineer the first day of each month.

The QCP shall also include the name and qualifications of a Quality Control Manager. The Quality Control Manager shall be responsible for the administration of the QCP, including compliance with the plan and any plan modifications.

The Contractor shall submit complete production testing records to the Engineer within 24 hours in a manner acceptable to the Engineer.

The QCP shall also include the name and qualifications of any outside testing laboratory performing any QC functions on behalf of the Contractor. The QCP must also include a list of sampling & testing methods and frequencies used during production, and the names of all Quality Control personnel and their duties.

Approval of the QCP does not imply any warranty by the Engineer that adherence to the plan will result in production of bituminous concrete that complies with these specifications. The Contractor shall submit any changes to the QCP as work progresses.

2. Acceptance Sampling & Testing Methods:

i. General:

Acceptance samples of mixtures shall be obtained from the hauling vehicles and tested by the Contractor at the facility during each day's production.

The Contractor shall submit all acceptance tests results to the Engineer within 24 hours or prior to the next day's production. All acceptance test specimens and supporting documentation must be retained by the Contractor. Verification testing will be performed by the Engineer in accordance with the Department's QA Program for Materials. Labeled Acceptance test specimens shall be retained at the production facilities and may be disposed of with the approval of the Engineer. All Quality Control specimens shall be clearly labeled and separated from the Acceptance specimens.

Should the Department be unable to verify the Contractor's acceptance test result(s) due to a failure of the Contractor to retain acceptance test specimens or supporting documentation, the Contractor shall review its quality control plan, determine the cause of the nonconformance and respond in writing within 24 hours to the Engineer describing the corrective action taken at the plant. In addition, the Contractor must provide supporting documentation or test results to validate the subject acceptance test result(s). The Engineer may invalidate any positive adjustments for material corresponding to the acceptance test(s). Failure of the Contractor to adequately address quality control issues at a facility may result in suspension of production for Department projects at that facility.

Contractor personnel performing acceptance sampling and testing must be present at the facility prior to, during, and until completion of production, and be certified as a NETTCP HMA Plant Technician or Interim HMA Plant Technician and be in good standing. Production of material for use on State projects must be suspended by the Contractor if such personnel are not present.

Technicians found by the Engineer to be non-compliant with NETTCP or Department policies may be removed by the Engineer from participating in the acceptance testing process for Department projects until their actions can be reviewed.

Anytime during production that testing equipment becomes inoperable, production can continue for a maximum of 1 hour. The Contractor shall obtain box sample(s) in accordance with Table M.04.03-1 to satisfy the daily acceptance testing requirement for the quantity shipped to the project. The box sample(s) shall be tested once the equipment issue has been resolved to the satisfaction of the Engineer. Production beyond 1 hour may be considered by the Engineer. Production will not be permitted beyond that day until the subject equipment issue has been resolved.

ii. Curb Mix Acceptance Sampling and Testing Procedures:

Curb Mixes shall be tested by the Contractor at a frequency of one test per every 250 tons of cumulative production, regardless of the day of production.

When these mix designs are specified, the following acceptance procedures and AASHTO test methods shall be used:

TABLE M.04.03 – 2: Curb Mix Acceptance Test Procedures

Protocol	Reference	Description
1	AASHTO T 30(M)	Mechanical Analysis of Extracted Aggregate
2	AASHTO T 168	Sampling of Bituminous Concrete
3	AASHTO T 308	Binder content by Ignition Oven method (adjusted for aggregate correction factor)
4	AASHTO T 209(M)	Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
5	AASHTO T 312	Superpave Gyratory molds compacted to N_{des}
6	AASHTO T 329	Moisture Content of Hot-Mix Asphalt (HMA) by Oven Method

a. Determination of Off-Test Status:

- i. The test results of AASHTO T 308 and T 30(M) will be used to determine if the mixture is within the tolerances shown in Table M.04.02-1. Curb Mixtures are considered “off test” when the test results indicate that any single value for bitumen content or gradation are not within the tolerances shown in Table M.04.02-1 for that mixture. If the mix is “off test”, the Contractor must take immediate actions to correct the deficiency and a new acceptance sample shall be tested on the same day or the following day of production.
- ii. When multiple plants and silos are located at one site, mixture supplied to one project is considered as coming from one source for the purpose of applying the “off test” status.

- iii. The Engineer may cease supply from the plant when test results from three consecutive samples are not within the JMF tolerances or the test results from two consecutive samples not within the master range indicated in Table M.04.02-1 regardless of production date.

b. JMF Changes

- i. If a test indicates that the bitumen content or gradation are outside the tolerances, the Contractor may make a single JMF change as allowed by the Engineer prior to any additional testing. A JMF change shall include the date and name of the Engineer that allowed it. Consecutive test results outside the requirements of Table M.04.02-1 JMF tolerances may result in rejection of the mixture.
- ii. Any modification to the JMF shall not exceed 50% of the JMF tolerances indicated in Table M.04.02-1 for any given component of the mixture without approval of the Engineer. When such an adjustment is made to the bitumen, the corresponding production percentage of bitumen shall be revised accordingly.

iii. Superpave Mix Acceptance Sampling and Testing Procedures:

The hauling vehicle from which samples are obtained shall be selected using stratified – random sampling based on the total estimated tons of production in accordance with ASTM D 3665, except that the first test shall be randomly taken from the first 151 tons or as directed by the Engineer. The Engineer may request a second acceptance test within the first sub lot. One acceptance test shall always be performed in the last sub-lot based on actual tons of material produced.

The number of sub lots/acceptance tests is based on the total production per day as indicated in Table M.04.03-1. Quantities of the same type/level mix per plant may be combined daily for multiple state projects to determine the number of sub lots. The Engineer may direct that additional acceptance samples be obtained to represent materials actually being delivered to the project.

The payment adjustment for air voids and liquid binder will be calculated per sub lot as described in Section 4.06.

An acceptance test shall not be performed within 150 tons of production from a previous acceptance test unless approved by the Engineer. Quality Control tests are not subject to this restriction. Unless otherwise tested, a minimum of one (1) acceptance test shall be performed for every four days of production at a facility for each type/level mix (days of production may or may not be consecutive days).

TABLE M.04.03 – 1:
Superpave Acceptance Testing Frequency per Type/Level/Plant

Daily quantity produced in tons (lot)	Number of Sub Lots/Tests
0 to 150	0, Unless requested by the Engineer
151 to 600	1
601 to 1,200	2
1,201 to 1,800	3
1,801 or greater	1 per 600 tons or portions thereof

When the Superpave mix design is specified, the following acceptance and AASHTO test procedures shall be used:

TABLE M.04.03– 3: Superpave Acceptance Testing Procedures

Protocol	Reference	Description
1	AASHTO T 168	Sampling of bituminous concrete
2	AASHTO R 47	Reducing samples to testing size
3	AASHTO T 308	Binder content by Ignition Oven method (adjusted for aggregate correction factor)
4	AASHTO T 30	Gradation of extracted aggregate for bituminous concrete mixture
5	AASHTO T 312	⁽¹⁾ Superpave Gyratory molds compacted to N _{des}
6	AASHTO T 166	⁽²⁾ Bulk specific gravity of bituminous concrete
7	AASHTO R 35	⁽²⁾ Air voids, VMA
8	AASHTO T 209(M)	Maximum specific gravity of bituminous concrete (average of two tests)
9	AASHTO T 329	Moisture content of Production bituminous concrete

Notes: ⁽¹⁾ One set equals two six-inch molds. Molds to be compacted to N_{max} for PPTs and to N_{des} for production testing. The first subplot of the year will be compacted to N_{max}

⁽²⁾ Average value of one set of six-inch molds.

If the average corrected Pb content differs by 0.3% or more from the average bituminous concrete facility production delivery ticket in five (5) consecutive tests regardless of the production date (moving average), the Contractor shall immediately investigate, determine an assignable cause and correct the issue. When two consecutive moving average differences are 0.3% or more, the Engineer may require a new aggregate correction factor.

The test specimen must be ready to be placed in an approved ignition furnace for testing in accordance with AASHTO T 308 within thirty minutes of being obtained from the hauling vehicle and the test shall start immediately after.

The Contractor shall perform moisture susceptibility (TSR) testing annually for all design levels of HMA-, WMA-, and PMA- S0.5 plant-produced mixtures, in accordance with the latest version of AASHTO T 283(M).

If any material source changes from the previous year, or during the production season, a mix design TSR as well as a production TSR is required for the new mixture. The AASHTO T 283(M) test shall be performed at an AASHTO Materials Reference Laboratory (AMRL) by NETTCP Certified Technicians. The test results and specimens shall be submitted to the Engineer for review. This shall be completed within 30 days from the start of production. Superpave mixtures that require anti-strip additives (either liquid or mineral) shall continue to meet all requirements specified herein for binder and bituminous concrete. The Contractor shall submit the name, manufacturer, percent used, technical datasheet and SDS for the anti-strip additive (if applicable) to the Engineer. In addition, compaction of samples shall be accomplished utilizing an accepted Superpave Gyratory Compactor (SGC), supplied by the Contractor. The SGC shall be located at the facility supplying mixture to the project.

a. Determination of Off-Test Status:

- i. Superpave mixes shall be considered "*off test*" when any Control Point Sieve, VA, VMA, and Gmm values are outside of the limits specified in Table M.04.03-4 and the computed binder content (Pb) established by AASHTO T308 or as documented on the vehicle delivery ticket is below the minimum binder content stated in sub article M.04.02-5. Note that further testing of samples or portions of samples not initially tested for this purpose cannot be used to change the status.
- ii. Any time the bituminous concrete mixture is considered Off-test:
 1. The Contractor shall notify the Engineer (and project staff) when the plant is "*off test*" for a type of mixture. When multiple plants and silos are located at one site, mixture supplied to one project is considered as coming from one source for the purpose of applying the "*off test*" determination.
 2. The Contractor must take immediate actions to correct the deficiency, minimize "*off test*" production to the project, and obtain an additional Process Control (PC) test after any corrective action to verify production is in conformance to the specifications. A PC test will not be used for acceptance and is solely for the use of the Contractor in its quality control process.

- b. Cessation of Supply for Superpave Mixtures with no Payment Adjustment: Production of bituminous concrete shall cease for the Project from any plant that consistently fails to produce mixture that meets the JMF and volumetric properties. The quantity of Superpave mixtures shipped to the project that is "off-test" will not be adjusted for deficient mixtures.

A Contractor shall cease to supply mixture from a plant when:

1. Bituminous concrete mixture is “off test” on three (3) consecutive tests for any combination of VMA or Gmm, regardless of date of production.
2. Bituminous concrete mixture is “off test” on two (2) consecutive tests for the Control Point sieves in one day’s production.

Following cessation, the Contractor shall immediately make necessary material or process corrections and run a Pre-Production Trial (PPT) for that type of mixture. Use of that type of mixture from that plant will be prohibited on the Project until the Contractor has demonstrated the ability to produce acceptable mixture from that facility. When the Contractor has a passing test and has received approval from the Engineer, the use of that mixture to the Project may resume.

- c. Cessation of Supply for Superpave Mixtures with Payment Adjustment: Production of bituminous concrete shall cease for the Project from any plant that consistently fails to produce mixture that meets the Superpave minimum binder content by mix type and level listed in Table M.04.02-5. The quantity of Superpave mixtures shipped to the project that is “off-test” will be adjusted for deficient mixtures in accordance with Section 4.06.

A Contractor shall cease to supply mixture from a plant when:

1. The binder content (Pb) is below the requirements of Table M.04.02-5 on the ignition oven test result after two (2) consecutive tests, regardless of the date of production.
2. The air voids (VA) is outside the requirements of Table M.04.03-4 after three (3) consecutive tests, regardless of the date of production.

Following cessation, the Contractor shall immediately make necessary material or process corrections and run a Pre-Production Trial (PPT) for that type of mixture. Use of that type of mixture from that plant will be prohibited on the Project until the Contractor has demonstrated the ability to produce acceptable mixture from that facility. When the Contractor has a passing test and has received approval from the Engineer, the use of that mixture to the Project may resume.

- d. JMF Changes for Superpave Mixture Production: It is understood that a JMF change is effective from the time it was submitted forward and is not retroactive to the previous test or tests. JMF changes are permitted to allow for trends in aggregate and mix properties but every effort shall be employed by the Contractor to minimize this to ensure a uniform

and dense pavement. A revised JMF submittal shall include the date and name of the Engineer that allowed it.

JMF changes are only permitted prior to or after a production shift for all bituminous-concrete types of mixtures and only when they:

- i. Are requested in writing and pre-approved by the Engineer.
- ii. Are based on a minimum of a two test trend.
- iii. Are documented with a promptly submitted revised JMF on the form provided by the Engineer.
- iv. A revised JMF submittal shall include the date and name of the Engineer that allowed it.

No change will be made on any aggregate or RAP consensus property or specific gravity unless the test is performed at an AASHTO Materials Reference Laboratory (AMRL) by NETTCP Certified Technicians.

A JMF change shall be submitted every time the plant target RAP and/or bin percentage deviates by more than 5% and/or the plant target binder content deviates by more than 0.15% from the active JMF.

TABLE M.04.03– 4: Superpave Master Range for Bituminous Concrete Mixture Production

Notes: (1) 300°F minimum after October 15. (2) Minimum Pb as specified in Table M.04.02-5 (3) Control point range is also defined as the master range for that mix. (4) JMF tolerances shall be defined as the limits for production compliance. VA & Pb payment is subject to adjustments, as defined in sub-article 4.06.04 - 2. (5) For WMA, lower minimum aggregate temperature will require Engineer's approval. (6) For WMA and/or polymer modified asphalt, the mix temperature shall meet manufacturer's recommendations. In addition, for WMA, the maximum mix temperature shall not exceed 325°F once the WMA technology is incorporated.									
	S0.25		S0.375		S0.5		S1		Tolerances
Sieve	CONTROL POINTS ⁽⁴⁾		CONTROL POINTS ⁽⁴⁾		CONTROL POINTS ⁽⁴⁾		CONTROL POINTS ⁽⁴⁾		From JMF Targets ⁽⁴⁾
inches	Min(%)	Max(%)	Min(%)	Max(%)	Min(%)	Max(%)	Min(%)	Max(%)	±Tol
1.5	-	-	-	-	-	-	100	-	
1.0	-	-	-	-	-	-	90	100	
3/4	-	-	-	-	100	-	-	90	
1/2	100	-	100	-	90	100	-	-	
3/8	97	100	90	100	-	90	-	-	
#4	-	90	-	90	-	-	-	-	
#8	32	67	32	67	28	58	19	45	
#16	-	-	-	-	-	-	-	-	
#200	2.0	10.0	2.0	10.0	2.0	10.0	1.0	7.0	
Pb ⁽²⁾	-	-	-	-	-	-	-	-	note (2)
VMA (%)	16.0		16.0		15.0		13.0		1.0
VA (%)	4.0		4.0		4.0		4.0		1.0
Gmm	JMF value		JMF value		JMF value		JMF value		0.030
Agg. Temp ⁽⁵⁾	280 – 350F		280 – 350F		280 – 350F		280 – 350F		
Mix Temp ⁽⁶⁾	265 – 325 F ⁽¹⁾		265 – 325 F ⁽¹⁾		265 – 325 F ⁽¹⁾		265 – 325 F ⁽¹⁾		
Prod. TSR	N/A		N/A		≥80%		N/A		
T-283 Stripping	N/A		N/A		Minimal as determined by the Engineer		N/A		

TABLE M.04.03– 5:
JMF Tolerances for Application
of Positive Adjustments

Notes: (1) Only for S1 mixes. (2) Only for S0.5 and S1 mixes.	
Sieve	Tolerances From JMF Targets
inches	±Tol
3/4	9 (1)
1/2	9 (1)
3/8	9 (2)
#4	8
#8	7
#16	6
#200	3
Pb	0.4

TABLE M.04.03– 6:
Superpave Master Range for Traffic Levels and Design Volumetric Properties

Traffic Level	Design ESALs	Number of Gyration by Superpave Gyrotory Compactor	
	(million)	Nini	Ndes
1*	< 0.3	6	50
2	0.3 to < 3.0	7	75
3	≥3.0	8	100

* NOTE: Level 1 for use by Towns and Municipalities ONLY.

**TABLE M.04.03-7:
Modifications to Standard AASHTO and ASTM Test Specifications and Procedures**

AASHTO Standard Specification	
Reference	Modification
M 140	Emulsified Asphalt grade RS-1H shall meet all the requirements of the emulsified asphalt grade RS-1 except for the penetration requirement of the residue that will change from 100 to 200 penetration units (0.1 mm) to 40 to 90 penetration units (0.1 mm).
AASHTO Standard Method of Test	
Reference	Modification
T 30	Section 7.2 thru 7.4 Samples are not routinely washed for production testing
T 168	Samples are taken at one point in the pile. Samples from a hauling vehicle are taken from only one point instead of three as specified. Selection of Samples: Sampling is equally important as the testing, and the sampler shall use every precaution to obtain samples that are truly representative of the bituminous mixture. Box Samples: In order to enhance the rate of processing samples taken in the field by construction or maintenance personnel the samples will be tested in the order received and data processed to be determine conformance to material specifications and to prioritize inspections by laboratory personnel.
T 195	Section 4.3 only one truck load of mixture is sampled. Samples are taken from opposite sides of the load.
T 209	Section 7.2 The average of two bowls is used proportionally in order to satisfy minimum mass requirements. 8.3 Omit Pycnometer method.
T 283	When foaming technology is used, the material used for the fabrication of the specimens shall be cooled to room temperature, and then reheated to the manufactures recommended compaction temperature prior to fabrication of the specimens.
T 331	6.1 Cores are dried to a constant mass prior to testing using a core-dry machine.

AASHTO Standard Recommended Practices	
Reference	Modification
R 26	<p>Quality Control Plans must be formatted in accordance with AASHTO R 26, certifying suppliers of performance-graded asphalt binders, Section 9.0, Suppliers Quality Control Plan, and “NEAUPG Model PGAB QC Plan.”</p> <ol style="list-style-type: none"> 1. The Department requires that all laboratory technician(s) responsible for testing PG-binders be certified or Interim Qualified by the New England Transportation Technician Certification Program (NETTCP) as a PG Asphalt Binder Lab Technician. 2. Sampling of asphalt binders should be done under the supervision of qualified technician. NECTP “Manual of Practice,” Chapter 2 Page 2-4 (Key Issues 1-8). 3. A copy of the Manual of Practice for testing asphalt binders in accordance with the Superpave PG Grading system shall be in the testing laboratory. 4. All laboratories testing binders for the Department are required to be accredited by the AASHTO Materials Reference Laboratory (AMRL). 5. Sources interested in being approved to supply PG-binders to the Department by use of an “in-line blending system,” must record properties of blended material, and additives used. 6. Each source of supply of PG-binder must indicate that the binders contain no additives used to modify or enhance their performance properties. Binders that are manufactured using additives, modifiers, extenders etc., shall disclose the type of additive, percentage and any handling specifications/limitations required. 7. All AASHTO M 320 references shall be replaced with AASHTO M 332. 8. Each year, in April and September, the supplier shall submit test results for two BBR testing at two different temperatures in accordance with AASHTO R 29. <p>Suppliers shall provide AASHTO M 332 testing results and split samples at a minimum of once per lot.</p>

ON-THE-JOB TRAINING (OJT) WORKFORCE DEVELOPMENT PILOT

Description

To provide construction industry related job opportunities to minorities, women and economically disadvantaged individuals; and to increase the likelihood of a diverse and inclusive workforce on Connecticut Department of Transportation (ConnDOT) projects.

All contractors (existing and newcomers) will be automatically placed in the Workforce Development Pilot. Standard OJT requirements typically associated with individual projects will no longer be applied at the project level for new projects. Instead, these requirements will be applicable on an annual basis for each contractor performing work on ConnDOT projects.

The OJT Workforce Development Pilot will allow a contractor to train employees on Federal, State and privately funded projects located in Connecticut. However, contractors should give priority to training employees on ConnDOT Federal-Aid funded projects.

Funding

The Department will establish an OJT fund annually from which contractors may bill the Department directly for eligible trainee hours. The funds for payment of trainee hours on federal-aid projects will be allocated from the ½ of 1% provided for OJT funding, and will be based on hours trained, not to exceed a maximum of \$25,000.00 per year; per contractor.

Minorities and Women

Developing, training and upgrading of minorities, women and economically disadvantaged individuals toward journeyman level status is the primary objective of this special training provision. Accordingly, the Contractor shall make every effort to enroll minority, women and economically disadvantaged individuals as trainees to the extent that such persons are available within a reasonable area of recruitment. This training commitment is not intended, and shall not be used, to discriminate against any applicant for training whether a member of a minority group or not.

Assigning Training Goals

The Department, through the OJT Program Coordinator, will assign training goals for a calendar year based on the contractor's past two year's activities and the contractor's anticipated upcoming year's activity with the Department. At the beginning of each year, all contractors eligible will be contacted by the Department to determine the number of trainees that will be assigned for the upcoming calendar year. At that time, the Contractor shall enter into an agreement with the Department to provide a self-imposed on-the-job training program for the calendar year. This agreement will include a specific number of annual training goals agreed to by both parties. The number of training assignments may range from one (1) to six (6) per

contractor per calendar year. Each January, a summary of the trainees required and the OJT Workforce Development Pilot package will be sent to participating contractors. The number of trainees assigned to each contractor in the summary will increase proportionately not to exceed 6, as shown in the following table. This package will also be provided to contractors as they become newly eligible for the OJT Workforce Development Pilot throughout the remainder of the year. Projects awarded after September 30 will be included in the following year's Program.

The dollar thresholds for training assignments are as follows:

\$4.5 – 8 million=	1 trainee
\$ 9 – 15 million=	2 trainees
\$16 – 23 million=	3 trainees
\$24 – 30 million=	4 trainees
\$31 – 40 million=	5 trainees
\$41 – and above=	6 trainees

Training Classifications

Preference shall be given to providing training in the following skilled work classifications. However, the classifications established are not all-inclusive:

Equipment Operators	Electricians
Laborers	Painters
Carpenters	Iron / Reinforcing Steel Workers
Concrete Finishers	Mechanics
Pipe Layers	Welders

The Department has on file common training classifications and their respective training requirements; that may be used by the contractors. Contractors shall submit new classifications for specific job functions that their employees are performing. The Department will review and recommend for acceptance the new classifications proposed by contractors, if applicable. New classifications shall meet the following requirements:

Proposed training classifications are reasonable and realistic based on the job skill classification needs, and the number of training hours specified in the training classification is consistent with common practices and provides enough time for the trainee to obtain journeyman level status.

Where feasible, 25% percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training. The number of trainees shall be distributed among the work classifications on the basis of the contractor's needs and the availability of journeymen in the various classifications within a reasonable area of recruitment.

No employee shall be employed as a trainee in any classification in which they have successfully completed a training course leading to journeyman level status or in which they have been employed as a journeyman.

Records and Reports

The Contractor shall maintain enrollment in the program and submit all required reports documenting company compliance under these contract requirements. These documents and any other information shall be submitted to the OJT Program Coordinator as requested.

Upon the trainee's completion and graduation from the program, the Contractor shall provide each trainee with a certification Certificate showing the type and length of training satisfactorily completed.

Trainee Interviews

In order to determine the continued effectiveness of the OJT Program in Connecticut, the department will periodically conduct personal interviews with current trainees and may survey recent graduates of the program. This enables the OJT Program Coordinator to modify and improve the program as necessary. Trainee interviews are generally conducted at the job site to ensure that the trainees' work and training is consistent with the approved training program.

Trainee Wages

Contractors shall compensate trainees on a graduating pay scale based upon a percentage of the prevailing minimum journeyman wages (Davis-Bacon Act). Minimum pay shall be as follows:

60 percent	of the journeyman wage for the first half of the training period
75 percent	of the journeyman wage for the third quarter of the training period
90 percent	of the journeyman wage for the last quarter of the training period

In no case, will the trainee be paid less than the prevailing rate for general laborer as shown in the contract wage decision (must be approved by the Department of Labor).

Achieving or Failing to Meet Training Goals

The Contractor will be credited for each trainee currently enrolled or who becomes enrolled in the approved training program and providing they receive the required training under the specific training program. Trainees will be allowed to be transferred between projects if required by the Contractor's schedule and workload. The OJT Program Coordinator must be notified of transfers within five (5) days of the transfer or reassignments by e-mail (Phylisha.Coles@ct.gov).

Where a contractor does not or cannot achieve its annual training goal with female or minority trainees, they must produce adequate Good Faith Efforts documentation. Good Faith Efforts are those designed to achieve equal opportunity through positive, aggressive, and continuous result-oriented measures. 23 CFR § 230.409(g) (4). Contractors should request minorities and females from unions when minorities and females are under-represented in the contractor's workforce.

Whenever a contractor requests ConnDOT approval of someone other than a minority or female, the contractor must submit documented evidence of its Good Faith Efforts to fill that position with a minority or female. When a non-minority male is accepted, a contractor must continue to attempt to meet its remaining annual training goals with females and minorities.

Where a contractor has neither attained its goal nor submitted adequate Good Faith Efforts documentation, ConnDOT will issue a letter of non-compliance. Within thirty (30) days of receiving the letter of non-compliance, the contractor must submit a written Corrective Action Plan (CAP) outlining the steps that it will take to remedy the non-compliance. The CAP must be approved by ConnDOT. Failure to comply with the CAP may result in your firm being found non-responsive for future projects.

Measurement and Payment

Optional reimbursement will be made to the contractor for providing the required training under this special provision on ConnDOT Federal-Aid funded projects only.

Contractor will be reimbursed at \$0.80 for each hour of training given to an employee in accordance with an approved training or apprenticeship program. This reimbursement will be made even though the Contractor receives additional training program funds from other sources, provided such other source does not specifically prohibit the contractor from receiving other reimbursement.

Reimbursement for training is made annually or upon the trainees completion and not on a monthly basis. No payment shall be made to the Contractor if either the failure to provide the required training, or the failure to hire the trainee as a journeyman, is caused by the Contractor.

Program reimbursements will be made directly to the prime contractor on an annual basis. To request reimbursement, prime contractors must complete the Voucher for OJT Workforce Development Pilot Hourly Reimbursement for each trainee in the OJT Program. This form is included in the OJT Workforce Development Pilot package and is available on the Department's web site at:

www.ct.gov/dot

The completed form must be submitted to the Office of Contract Compliance for approval. The form is due on the 15th day of January for each trainee currently enrolled and for hours worked on ConnDOT Federal-Aid funded projects only.

SMALL CONTRACTOR AND SMALL CONTRACTOR MINORITY BUSINESS ENTERPRISES (SET-ASIDE)

March, 2001

NOTE: Certain of the requirements and procedures stated in this "Special Provision" are applicable prior to the execution of the Contract.

I. GENERAL

- A. The Contractor shall cooperate with the Connecticut Department of Transportation (CONNDOT) in implementing the required contract obligations concerning "Small Contractor" and "Small Contractor Minority Business Enterprise" use on this Contract in accordance with Section 4a-60g of the Connecticut General Statutes as revised. References, throughout this "Special Provision", to "Small Contractors" are also implied references to "Small Contractor Minority Business Enterprises" as both relate to Section IIA of these provisions. The Contractor shall also cooperate with CONNDOT in reviewing the Contractor's activities relating to this provision. This "Special Provision" is in addition to all other equal opportunity employment requirements of this Contract.
- B. For the purpose of this "Special Provision", the "Small Contractor(s)" and "Minority Business Enterprise(s)" named to satisfy the set-aside requirement must be certified by the Department of Administrative Services, Business Connections/ Set-Aside Unit [(860) 713-5236 www.das.state.ct.us/busopp.htm] as a "Small Contractor" and "Minority Business Enterprises" as defined by Section 4a-60g Subsections (1) and (3) of the Connecticut General Statutes as revised and is subject to approval by CONNDOT to do the work for which it is nominated pursuant to the criteria stipulated in Section IIC-3.
- C. Contractors who allow work which they have designated for "Small Contractor" participation in the pre-award submission required under Section IIC to be performed by other than the approved "Small Contractor" organization and prior to concurrence by CONNDOT, will not be paid for the value of the work performed by organizations other than the "Small Contractor" designated.
- D. If the Contractor is unable to achieve the specified contract goals for "Small Contractor" participation, the Contractor shall submit written documentation to CONNDOT's Manager of Construction Operations indicating his/her good faith efforts to satisfy goal requirements. Documentation is to include but not be limited to the following:

1. A detailed statement of the efforts made to select additional subcontract opportunities for work to be performed by each "Small Contractor" in order to increase the likelihood of achieving the stated goal.
 2. A detailed statement, including documentation of the efforts made to contact and solicit contracts with each "Small Contractor", including the names, addresses, dates and telephone numbers of each "Small Contractor" contacted, and a description of the information provided to each "Small Contractor" regarding the scope of services and anticipated time schedule of items proposed to be subcontracted and the nature of response from firms contacted.
 3. For each "Small Contractor" that placed a subcontract quotation which the Contractor considered not to be acceptable, provide a detailed statement of the reasons for this conclusion.
 4. Documents to support contacts made with CONNDOT requesting assistance in satisfying the contract specified or adjusted "Small Contractor" dollar requirements.
 5. Document other special efforts undertaken by the Contractor to meet the defined goal.
- E. Failure of the Contractor to have at least the specified dollar amount of this contract performed by "Small Contractor" as required in Section IIA of this "Special Provision" will result in the reduction in contract payment to the Contractor by an amount equivalent to that determined by subtracting from the specific dollar amount required in Section IIA, the dollar payments for the work actually performed by each "Small Contractor". The deficiency in "Small Contractor" achievement, will therefore, be deducted from the final contract payment. However, in instances where the Contractor can adequately document or substantiate its good faith efforts made to meet the specified or adjusted dollar amount to the satisfaction of CONNDOT, no reduction in payments will be imposed.
- F. All records must be retained for a period of three (3) years following completion of the contract and shall be available at reasonable times and places for inspection by authorized representatives of CONNDOT.
- G. Nothing contained herein, is intended to relieve any contractor or subcontractor or material supplier or manufacturer from compliance with all applicable Federal and State legislation or provisions concerning equal employment opportunity, affirmative action, nondiscrimination and related subjects during the term of this Contract.

II. SPECIFIC REQUIREMENTS

In order to increase the participation of "Small Contractors", CONNDOT requires the following:

- A. Not less than 12.0 (%) percent of the **final** value of this Contract shall be subcontracted to and performed by, and/or supplied by, manufactured by and paid to "Small Contractors" and/or "Small Contractors Minority Business Enterprises".

If the above percentage is zero (0%) AND an asterisk () has been entered in the adjacent brackets [], this Contract is 100% solely set-aside for participation by "Small Contractors" and/or "Small Contractors Minority Business Enterprises".*

- B. The Contractor shall assure that each "Small Contractor" will have an equitable opportunity to compete under this "Special Provision", particularly by arranging solicitations, time for the preparation of Quotes, Scope of Work, and Delivery Schedules so as to facilitate the participation of each "Small Contractor".
- C. The Contractor shall provide to CONNDOT's Manager of Contracts within Seven (7) days after the bid opening the following items:
1. An affidavit (Exhibit I) completed by each named "Small Contractor" subcontractor listing a description of the work and indicating the dollar amount of all contract(s) and/or subcontract(s) that have been awarded to him/her for the current State Fiscal Year (July 1 - June 30) does not exceed the Fiscal Year limit of \$10,000,000.00.
 2. A certification of work to be subcontracted (Exhibit II) signed by both the Contractor and the "Small Contractor" listing the work items and the dollar value of the items that the nominated "Small Contractor" is to perform on the project to achieve the minimum percentage indicated in Section IIA above.
 3. A certification of past experience (Exhibit III) indicating the scope of work the nominated "Small Contractor" has performed on all projects, public and private, for the past two (2) years.
 4. In instances where a change from the originally approved named "Small Contractor" (see Section IB) is proposed, the Contractor is required to submit, in a reasonable and expeditious manner, a revised submission, comprised of the documentation required in Section IIC, Paragraphs 1, 2 and 3 and Section E together with documentation to substantiate and

justify the change, (i.e., documentation to provide a basis for the change) to CONNDOT's Manager of Construction Operations for its review and approval prior to the implementation of the change. The Contractor must demonstrate that the originally named "Small Contractor" is unable to perform in conformity to specifications, or unwilling to perform, or is in default of its contract, or is overextended on other jobs. The Contractor's ability to negotiate a more advantageous contract with another "Small Contractor" is not a valid basis for change. Documentation shall include a letter of release from the originally named "Small Contractor" indicating the reason(s) for the release.

- D. After the Contractor signs the Contract, the Contractor will be required to meet with CONNDOT's Manager of Construction Operations or his/her designee to review the following:
1. What is expected with respect to the "Small Contractor" set aside requirements.
 2. Failure to comply with and meet the requirement can and will result in monetary deductions from payment.
 3. Each quarter after the start of the "Small Contractor" the Contractor shall submit a report to CONNDOT's Manager of Construction Operations indicating the work done by, and the dollars paid to each "Small Contractor" to date.
 4. What is required when a request to sublet to a "Small Contractor" is submitted.
- E. The Contractor shall submit to CONNDOT's Manager of Construction Operations all requests for subcontractor approvals on standard forms provided by the Department.

If the request for approval is for a "Small Contractor" subcontractor for the purpose of meeting the contract required "Small Contractor" percentage stipulated in Section IIA, a copy of the legal contract between the Contractor and the "Small Contractor" subcontractor must also be submitted at the same time. Any subsequent amendments or modifications of the contract between the Contractor and the "Small Contractor" subcontractor must also be submitted to CONNDOT's Manager of Construction Operations with an explanation of the change(s). The contract must show items of work to be performed, unit prices and, if a partial item, the work involved by both parties.

In addition, the following documents are to be attached:

- (1) A statement explaining any method or arrangement for renting equipment. If rental is from a Contractor, a copy of Rental Agreement must be submitted.
 - (2) A statement addressing any special arrangements for manpower.
 - (3) A statement addressing who will purchase material.
- F. Contractors subcontracting with a "Small Contractor" to perform work or services as required by this "Special Provision" shall not terminate such firms without advising CONNDOT, in writing, and providing adequate documentation to substantiate the reasons for termination if the designated "Small Contractor" firm has not started or completed the work or the services for which it has been contracted to perform.

G. Material Suppliers or Manufacturers

If the Contractor elects to utilize a "Small Contractor" supplier or manufacturer to satisfy a portion or all of the specified dollar requirements, the Contractor must provide the Department with:

1. An executed Affidavit Small Contractor (Set-Aside) Connecticut Department of Transportation Affidavit Supplier or Manufacturer (sample attached), and
2. Substantiation of payments made to the supplier or manufacturer for materials used on the project.

Brokers and packagers shall not be regarded as material Suppliers or manufacturer.

H. Non-Manufacturing or Non-Supplier "Small Contractor" Credit

Contractors may count towards its "Small Contractor" goals the following expenditures with "Small Contractor" firms that are not manufacturers or suppliers:

1. Reasonable fees or commissions charged for providing a bona fide service such as professional, technical, consultant or managerial services and assistance in the procurement of essential personnel, facilities, equipment, material or supplies necessary for the performance of the contract provided that the fee or commission is determined by the Department of Transportation to be reasonable and consistent with fees customarily allowed for similar services.

2. The fees charged for delivery of materials and supplies required on a job site (but not the cost of the materials and supplies themselves) when the hauler, trucker, or delivery service is not also the manufacturer of or a regular dealer in the materials and supplies, provided that the fee is determined by the Department of Transportation to be reasonable and not excessive as compared with fees customarily allowed for similar services.
3. The fees or commissions charged for providing any bonds or insurance specifically required for the performance of the Contract, provided that the fee or commission is determined by the Department of Transportation to be reasonable and not excessive as compared with fees customarily allowed for similar services.

III. **BROKERING**

For the purpose of this "Special Provision", a "Broker" is one who acts as an agent for others in negotiating contracts, purchases, sales, etc., in return for a fee or commission. Brokering of work by a "Small Contractor" is not allowed and is a contract violation.

IV. **PRE-AWARD WAIVERS:**

If the Contractor's submission of the "Small Contractor" listing, as required by Section IIC indicates that it is unable, by subcontracting to obtain commitments which at least equal the amount required by Section IIA, it may request, in writing, a waiver of up to 50% of the amount required by Section IIA. To obtain such a waiver, the Contractor must submit a completed "Application for Waiver of Small Contractor Minority Business Enterprise Goals" to CONNDOT's Manager of Contracts which must also contain the following documentation:

1. Information described in Section ID.
2. For each "Small Contractor" contacted but unavailable, a statement from each "Small Contractor" confirming its unavailability.

Upon receipt of the submission requesting a waiver, the CONNDOT's Manager of Contracts shall submit the documentation to the Director of the Office of Contract Compliance who shall review it for completeness. After completion of the Director of Contract Compliance's review, she/he should write a narrative of his/her findings of the application for a waiver, which is to include his/her recommendation. The Director of Contract Compliance shall submit the written narrative to the Chairperson of the DBE Screening Committee at least five (5) working days before the scheduled meeting. The Contractor shall be invited to attend the meeting and present his/her position. The DBE Screening Committee shall render a decision on the waiver request within five (5)

working days after the meeting. The DBE Screening Committee's decision shall be final. Waiver applications are available from the CONNDOT Manager of Contracts.

Mar. 01

(* Delete if not Applicable)
SET-ASIDE PROGRAM
(QUALIFICATION AFFIDAVIT)

COUNTY OF _____

PERSON FIRM OR ORGANIZATION

<u>Col. 1</u> TOWN AND PROJECT NUMBER	<u>Col. 2</u> STATE AGENCY WHICH AWARDED CONTRACT	<u>Col. 3</u> CONTRACT AMOUNT AWARDED UNDER THIS PROGRAM	<u>Col. 4</u> AMOUNT OF WORK SUBCONTRACTED FROM OTHER FIRMS UNDER THIS PROGRAM	<u>Col. 5</u> TOTAL AMOUNT OF ALL WORK UNDER THIS PROGRAM Col. 3 Plus Col. 4
	TOTALS	\$	\$	\$

Mar.01

* Delete if not applicable

CONTRACTOR _____

ADDRESS _____

ADDRESS _____

TOWN _____ PROJECT NO. _____

TOWN _____ PROJECT NO. _____

DESCRIPTION OF PROJECT _____

CONTRACT BID AMOUNT \$ _____

DATE _____

Name, Address & Tel No. of the Nominated Firm	ITEM(s) NUMBER(s) and Description of the Item(s) to be performed by and paid to the Subcontractor	Quantities (indicate if partial)	Prime's Bid Amount For Item	Dollar Amount Subcontracted	Small Business Set-Aside Dollar Requirement

Signed By _____	Signed By _____
Small Contractor/*Minority Business Enterprise (Subcontractor)	Contractor

EXHIBIT III

CERTIFICATION
PAST CONSTRUCTION EXPERIENCE

Mar.01

SMALL CONTRACTOR / * MINORITY BUSINESS ENTERPRISES

* Delete if not applicable

PLEASE LIST ALL CONSTRUCTION PROJECTS YOUR ORGANIZATION HAS WORKED ON IN THE PAST TWO FISCAL YEARS

PROJECT LOCATION NUMBER AND DESCRIPTION APPLICABLE	CONTRACT AMOUNT	IF WORK PERFORMED AS PRIME GIVE OWNERS NAME IF WORK PERFORMED AS SUBCONTRACTOR GIVE CONTRACTORS NAME	START DATE	ACTUAL OR ESTIMATED COMPLETION DATE	NAME AND PHONE OF OWNER OR PRIME CONTRACTOR AS

SIGNED BY: _____

SMALL BUSINESS CONTRACTOR
 *MINORITY BUSINESS ENTERPRISES

D.O.T. PROJECT NO. _____

* Delete if not applicable

MARCH, 2001

**SMALL CONTRACTOR/SMALL CONTRACTOR MINORITY BUSINESS ENTERPRISE
(MBE) (SET-ASIDE) CONNECTICUT DEPARTMENT OF TRANSPORTATION
AFFIDAVIT – SUPPLIER OR MANUFACTURER**

This affidavit must be completed by the State Contractor's designated Small Contractor/ Small Contractor Minority Business Enterprise (MBE), notarized and attached to the contractor's request to utilize a Small Contractor/Small Contractor Minority Business Enterprise (MBE) supplier or manufacturer as a credit towards its Small Contractor/Small Contractor Minority Business Enterprise (MBE) contract requirement; failure to do so will result in not receiving credit towards the contract Small Contractor/Small Contractor Minority Business Enterprise (MBE) requirement.

State Project No. _____

Federal Aid Project No. _____

Description of Project _____

I, _____, acting in behalf of _____
(Name of person signing Affidavit) (Small Contractor/Small Contractor MBE contractor person,

_____ of which I am the _____ affirm that _____
firm, association or certify and corporation) (Title of Person) (Small

Contractor/Small Contractor MBE person, firm, association or corporation) _____ is a certified Small Contractor/Small

Contractor Minority Business Enterprise, as defined by Section 4a-60g of the Connecticut General Statutes, as revised.

I further certify and affirm that _____
(Small Contractor/Small Contractor MBE person, firm, association or corporation)

will assume the actual and contractual responsibility for the provision of the materials and/or supplies sought by _____. If a manufacturer, I produce goods from raw
(State Contractor)

materials or substantially alter them before resale, or if a supplier, I perform a commercially useful function in the supply process.

I understand that false statements made herein are punishable at Law (Sec. 53a-157, CGS, as revised).

(Name of Small Contractor/Small Contractor MBE person, firm, association or corporation)

(Signature and Title of Official making the Affidavit)

Subscribed and sworn to before me, the _____ day of _____ 200_____.

Notary Public (Commissioner of the Superior Court)

My Commission Expires _____

CERTIFICATE OF CORPORATION

I, _____, certify that I am the _____
(Official) of the Corporation named in the foregoing instrument; that I have been duly authorized to affix
the seal of the Corporation to such papers as require the seal; that _____, who
signed said instrument on behalf of the Corporation, was then _____ of
said corporation; that said instrument was duly signed for and in behalf of said Corporation by authority
of its governing body and is within the scope of its corporation powers.

(Signature of Person Certifying)

(Date)

(Corporate Seal)

ITEM #0000190A – NON-DESTRUCTIVE UTILITY INVESTIGATION

Description:

This item shall consist of investigating and locating utilities using non-destructive methods, using the services of a professional utility locating company in accordance with this specification. This item shall include the field survey/location, field paint/stake marking, and color marking on 40-scale plans provided by the Designer.

Equipment and Materials:

General: The Contractor shall provide all necessary equipment and materials needed to identify underground utilities through the use of non-destructive methods such as ground penetrating radar, magnetic or electrical detectors, and other such scanning methods.

Construction:

General: The locations of utilities present shall first be reviewed on the plans and in the field, reconciling all surface evidence of utilities (such as gate valves, manholes, handholes, etc) with what is depicted on the plans. The professional utility location company shall use this information to conduct the non-destructive locating, using the method appropriate to the utility being investigated. Types of utilities which will require locating shall include, but not be limited to, gas lines, water lines, sewer lines, drainage lines, electrical conduits/wires/cables/ductbanks and fiber optic cables, including related structures such as valves, handholes and manholes. In addition to the above, all areas subject to excavation or subsurface work for the Project shall be investigated for the presence of subsurface utilities whether or not the presence of existing utilities are indicated on the plans.

Marking and Labeling: All located utilities shall be tagged, marked, or labeled in the field using standard industrial/engineering/construction methods such as spray paint, stakes, vertical markers, labels, ribbons, identification tapes etc.

Marking Plans: All located utilities shall be marked on 40-scale contract plans provided by the Designer. The colors, patterns and/or symbols shall comply with current industrial/engineering/construction design standards. The limits of this work will correspond to the limit of work shown on the contract plans.

Coordination of Work: This work will be performed within the Noroton Heights Railroad Station Platform Replacement project limits which consist of the territory operated by Metro-North Railroad. The work must be accomplished simultaneously with ongoing daily railroad operations. The Contactor shall coordinate the professional utility locating Subcontractor's

activities with the Designer and Metro-North Railroad. Refer to the General Requirements of the Contract.

Method of Measurement:

Utility investigation shall not be measured for payment. Utility investigation shall include all work as specified in this Special Provision.

Basis of Payment:

Payment will be made at the contract lump sum price for non-destructive utility investigation, performed by a professional utility location company hired by the Contractor, and accepted by the Designer. This price shall be full compensation for furnishing all labor, equipment, tools and incidentals necessary to complete this item.

<u>Pay Item</u>	<u>Pay Unit</u>
Non-Destructive Utility Investigation	L.S.

ITEM #0000581A – 4” PVC DUCT BANKS – 2 DUCTS

Description:

Scope

- A. This Section specifies the furnishing, installation, connection, and site-specific detailed design of concrete-encased duct banks, direct buried conduits, and pre-cast concrete manholes and handholes as indicated on the Plans.
- B. The Contractor shall perform additional underground exploratory investigations as indicated on the Plans (i.e., test pits, utility detection services, etc.) to determine a clear path/space for all new underground duct banks, manholes, and handholes. Revisions are to be made to the relevant Plans by the Contractor based on the underground exploratory investigations. These alterations are to be submitted to the designer, along with the accompanying duct bank profile and detail drawings, for approval prior to proceeding with the work in the field.

Related Sections

Related requirements are included in, but not limited to, the following:

- A. Special Provision “26 05 20 - for “No. 10 Single Conductor”
- B. “Trenching and Backfilling”

References

- A. All work furnished under this Section shall be in accordance with the latest applicable standards of AASHTO, ASTM, NEMA, and National Electrical Code with regard to material, design, construction and testing, except for any specific variations provided in this Section. The standards applicable shall include, but not be limited to, the following:

<u>Organization</u>	<u>Number</u>	<u>Title</u>
AASHTO	M199	Reinforced Concrete Manhole Sections
AASHTO	HS20-44	Live Loads for Highway Bridges
ANSI	C80.1	Rigid Galvanized Steel Conduit
ASTM	A48	Gray Iron Casting
ASTM	A438	Transverse Bending Test
ASTM	C136	Coarse Aggregates
ASTM	C150	Portland Cement
ASTM	C827	Early Volume Change of Cementitious Mixtures
NEMA	TC-6	Polyvinyl Chloride (PVC) Plastic Utility Ducts for Underground Installations

Submittals

The Contractor shall submit the following:

- A. Catalog data on metallic and non-metallic conduit, all conduit couplings and fittings, manhole and handhole inserts, cable support material, waterproofing sealer, concrete curing compound, and concrete dye additive.
- B. Shop drawings of pre-cast manholes and handholes which show all accessories including layout of cable supports. The Contractor shall not commence the installation of the pre-cast manholes and handholes until the drawings are approved by the designer.
- C. Conduit Stub-Up Plans: Include for all locations where conduit transitions from below-grade to above-grade, such as at substation floor penetrations, switchgear, catenary feeder pole, and negative returns at impedance bonds.
- D. Detailed plan and profile installation drawings for duct banks, conduits, manholes, and handholes for the work shown on the Plans.

Materials:

Pre-cast Manholes and Handholes

- A. Manholes/handholes may be constructed monolithically or in sections. All manholes and handholes shall be watertight as practicable. Splices in manholes and handholes shall be suitable for submersible use. If the manhole is constructed in sections, the joint between sections shall be made watertight with an approved gasket or with an approved epoxy mortar grout.
- B. Manhole and handhole access openings shall be centered in the roof slab and duct bank knockouts shall be centered in the walls, unless otherwise noted. This shall be constructed in size and shape to accommodate the cast iron cover and frame as shown on the Plans.
- C. Manholes and handholes shall include duct bank knockouts, riser conduit knockouts, a sump with galvanized grate and a minimum depth of two inches, a ground rod, 7/8-inch minimum diameter galvanized steel pulling irons (8 per manhole, 4 per handhole), cable racks, and cast iron cover with lifting hooks and/or finger holes.
- D. Size: Minimum inside dimensions of manholes/handholes shall be as indicated on the Plans.

- E. Design Loads: Manhole and handhole design loads shall consist of live loads, live load impact, dead load, soil loads, hydrostatic loads and any other expected loads that may occur.
1. Live loads shall be for HS-20 for manholes, and handholes that will be installed a distance of nine (9) feet or greater from the centerline of track or Cooper E-80 for manholes and handholes situated less than nine (9) feet from centerline of track.
 2. Impact loading shall be 30 percent of the live loads.
 3. Soil loads shall consist of an earth cover over manhole from zero (0) feet minimum to five (5) feet maximum. Average unit weight of earth shall be assumed to be 100 lbs. per cubic feet.
 4. Hydrostatic loading shall be a hydrostatic head of nine (9) feet above base of manhole.
- F. The final production shop drawings shall be approved and signed by a Civil or Structural designer registered in the State of Connecticut.
- G. Concrete: Cement for concrete shall be Portland cement, meeting the requirements of ASTM C150, Type I or Type II. Concrete shall be thoroughly cured and shall attain a compressive strength of at least 3,000 psi before delivery, and 4,000 before installation. The proportions of materials for concrete shall be as follows:
1. Minimum number of sacks of cement per cu. yard of concrete = 7.
 2. Maximum size of coarse aggregate = $\frac{3}{4}$ inches.
 3. Maximum slump = 4 inches.
- H. Concrete reinforcing bars (if required) shall be in accordance with the provisions of the Contract Documents.
- I. Exterior surfaces of manholes/handholes shall be waterproofed with two coats of waterproofing sealer. The sealer shall be applied when the man-holes/handholes are manufactured and touched up in the field as required to repair damage during shipping and to seal field penetrations. The sealer shall be applied in accordance with the manufacturer's recommendations.
- J. Ground rods shall be in accordance with "SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS".

Manhole and Handhole Frames and Covers:

- A. Handhole frames and covers shall be as indicated on the Plans. Manhole frames and covers shall be cast from gray iron in accordance with the applicable requirements of ASTM A48, Class 30. Inscription on manhole covers shall be as indicated on the Plans. All frames and covers shall be rated “heavy duty” or stronger. All castings shall, at a minimum, be able to withstand AASHTO HS-20 traffic loading. The transverse bending test shall be considered the primary test for qualification and shall be conducted in accordance with the requirements of ASTM A-438.
- B. Cleaning and Inspection:
 - 1. All castings which have passed the required tests shall be thoroughly cleaned, inside and out, without the aid of acid or other liquid, and shall be subjected to careful inspection and hammer tests.
 - 2. The castings shall be of the dimensions indicated on the Plans and shall be free from sand or blowholes and cold shuts. No plugging or stopping of holes will be allowed. Casting lines and excess materials shall be ground smooth.

Manhole/Handhole Cable Supports

- A. Cable racks shall be surface-mounted with stainless steel bolts to ½ inch stainless steel anchor inserts and installed vertically, approximately two feet apart on each wall, without blocking any duct bank openings for the new or future duct banks.
 - 1. The exact locations and quantity of cable racks depend upon the exact locations of the pre-cast duct bank knockouts in each style of manhole/handhole and shall be subject to approval by the Engineer.
 - 2. Cable racks shall be heavy duty non-metallic UL listed glass reinforced polymer, Underground Devices Inc. or approved equal. The cable racks shall consist of:
 - a. A 36 inch long stanchion that shall be attached to the manhole/handhole wall in accordance with the manufacturer’s recommendations and shall incorporate recessed bolt mounting holes and multiple arm mounting holes that are four (4) inches apart.
 - b. Adjustable arms that lock into the stanchion. Holes or slots shall be provided in the arms for cable wire ties. Cable rack arm lengths

shall be appropriate for the manhole/handhole size and amount of cable being installed.

- B. The Contractor shall furnish manhole/handhole hardware, as specified hereinafter, or approved equal. Drop-in anchors shall have a 1/2-13 thread, a rated pullout working capacity of at least 2100 pounds and shall be made from either 303 or 316 stainless steel. A 316 stainless steel 1/2-13 hex head cap screw and a 316 stainless steel flat washer shall be used with each drop-in anchor.

Waterproofing

- A. Sealer for waterproofing exterior surfaces of manholes/handholes shall be a mineral colloid type asphalt emulsion, as manufactured by Hunt Process Company "Aqua Shield 124," or approved equal.

Aggregate Base

- A. Aggregate bases for manholes, handholes and pull boxes shall be No. 6 Crushed Stone. Each manhole shall have a twelve (12) inch minimum deep base. Each handhole and pull box shall have eight (8) inch minimum deep base.

Grout

- A. Non-shrinking, non-metallic grout shall be in accordance with ASTM C150 premixed compound capable of minimum compression strength of 4,000 pounds per square inch (psi).
- B. Water shall be clean and free from deleterious substances.
- C. Non-metallic non-shrinking grout shall be factory pre-mixed requiring only water addition in the field.
- D. Shrinkage, if any, shall be in accordance with ASTM C827.

Underground Duct Work

- A. All underground duct work shall be schedule 80 PVC unless noted otherwise. All stub-up conduit sweeps shall be large radius (48 inches minimum) Rigid Galvanized Steel (RGS) unless noted otherwise.
- B. Duct sizes shall be as indicated on the Plans.
- C. Reinforcement is required continuously for entire run of ductbank.
- D. Concrete Encasement: Concrete encasement for these duct banks shall contain not less than 6½ sacks of Class "C" concrete and shall have a compressive

strength at age 28 days of not less than 3000 psi. The maximum size of aggregate shall be ½ inch. The concrete shall be dyed a “Red” color with an approved concrete additive. Sump shall be between four (4) and six (6) inches. Forming material is not required during the construction of duct banks. The contractor shall use any means deemed acceptable by the Engineer to construct the duct bank to the dimensions and grades as shown on the plans. Trench forming will be considered an acceptable method.

- E. Conduits: PVC and RGS conduits and fittings shall be as specified herein. Asbestos cement conduit or fittings are prohibited.
- F. Separators: Conduit separators or spacers shall be non-metallic and of the type recommended by the conduit manufacturer.

Direct Buried Conduits

- A. Direct buried conduits shall be PVC Schedule 80 complete with couplings and fittings.
- B. All direct buried PVC conduit shall be capped with 3 inches of concrete and have warning tape above it.

Backfill

- A. Backfill material shall be in accordance with applicable parts of the Contract Documents and approved by the Engineer.

Marker

- A. Duct markers shall be located at the ends of all conduit runs except at structures, at approximately every 200 feet along the conduit run, and at each change in direction of the conduit run. Markers shall be placed approximately 2 feet to the right of the conduit when facing the longitudinal axis of the run and in the direction of the electrical load. Markers shall be made of Class “C” concrete and shall have a compressive strength at age 28 days of not less than 3000 psi. Markers shall be a 6 inch square or round section by 2 feet long. The top edges of the marker shall have a 1/2 inch chamfer all around. The letter “D” with two arrows shall be impressed or cast on top of the marker. One arrow shall be located below the letter and shall point toward the ducts. The second arrow shall be located adjacent to the letter and shall point in a direction parallel to the ducts. The letter and the arrows shall be V shaped and shall have a width of stroke at least 1/4 inch at the top, and depth of 1/4 inch. The top of the markers shall be flush with the adjacent elevation of the paved or unpaved areas. Where the duct

bank changes direction, the arrow located adjacent to the letter shall be cast or impressed with an angle in the arrow approximately the same as the angular change of the run. Marker tape shall be Greenlee No. 435, or approved equal.

Construction Methods:

Excavation and Backfill

- A. Excavation and backfill shall be performed in accordance with the Contract Documents and approved by the Engineer.

Installation of Pre-cast Manholes and Handholes

- A. The Contractor shall install pre-cast concrete manholes/handholes as indicated on the Plans and as approved by the designer.
- B. Prior to burial and installation, field-apply two (2) coats of concrete sealer to exterior surfaces of the manhole/handhole around the duct bank penetrations, conduit penetrations, frame, and field joints. Sealer shall be applied in accordance with the manufacturer's recommendations and must be of high quality to prevent water entry.
- C. Manhole/handhole cover and frame shall be installed as shown on the approved shop drawings. Cover frame shall be adjusted level and flush with finished grade.
- D. Weld manhole/handhole identification names to each cover. The identification names shall be recommended by the Contractor and approved by the Engineer prior to procuring manholes and handholes.
- E. Install a ground rod in each manhole and handhole so that eight inches of the ground rod protrudes above the concrete floor and seal around ground rod with grout finished to match floor. Bond ground rod to metallic cable supports, rigid steel conduit terminations and other metallic components with #4/0 AWG bare copper cable..

Installation of Conduits and Duct Banks

- A. Conduits shall be installed as shown on the Plans. Duct bank configuration may be adapted to route obstructions such as underground utilities per the designer's approval; such adaptations may include rotating and fanning out of ducts.
- B. Conduits: Minimum depth of conduits from final grade to top of duct bank shall be 18 inches when not under track and 54 inches when located under track. Contractor shall coordinate installation of conduits with the designer.

- C. The manufacturer's directions shall be followed in placing all conduits, fittings, supports and spacers, and in compensating for temperature effects.
- D. Spacers shall be placed at not greater than five (5) feet intervals on center. Use of metallic spacers will not be permitted. Spacer system shall be designed to support duct bank longitudinal reinforcing bars. Unless noted otherwise on the Plans, install one (1) #5 longitudinal reinforcement bar through the spacers at each of the four outer corners of the duct bank, providing a minimum of one (1) inch of concrete cover over the bars. The ductbank and spacing details shall be as shown on the Plans.
- E. For concrete-encased duct banks, the concrete shall completely encase the duct bank without disturbing its vertical or horizontal alignment or damaging the conduits.
- F. The exposed surface of duct encasement concrete shall be floated smooth after placement, and an approved curing compound shall be applied in conformance with the concrete manufacturer's recommendations.
- G. Conduit terminations at manholes and handholes shall be fitted with end bells. The Contractor shall seal around all duct bank openings in the manhole and handhole walls with non-shrink grout and waterproofing sealer as approved by the designer.
- H. At all stages of the work, the Contractor shall exercise care to prevent foreign materials from entering the ducts.
- I. Following installation, each conduit shall be thoroughly cleaned and then tested by the successful pulling of a brush and mandrel approved by the Engineer. The mandrel shall be not less than ¼ inch smaller than the inside nominal diameter of the conduit. The Contractor shall give the Engineer 24 hours notice prior to witness the cleaning and testing.
- J. A 1/8-inch nylon pull rope shall be installed in each conduit run and secured at each end.
- K. Marker tape shall be furnished in a continuous length without splices and installed in one conduit of each duct run. The tape shall be secured at each end inside the manhole and handhole.
- L. All conduit terminations shall be plugged using approved removable plugs.
- M. Warning tape is to be installed in the fill over all duct banks at a depth of approximately one (1) foot below finished grade. This tape shall be over the longitudinal centerline of the duct banks and shall have appropriate language

written on the tape that warns of the presence of cable duct banks below the tape and to not proceed with any excavation in the area.

- N. Pulling tension of cable shall not exceed the cable manufacturer's recommendations.
- O. Connections to Manholes/Handholes: Duct bank envelopes connecting to manholes and handholes shall be flared to have an enlarged cross-section at the manhole/handhole opening dimensions by no less than twelve (12) inches in each direction. The perimeter of the duct bank opening in the manhole/handhole shall be flared toward the inside or keyed to provide for a positive interlock between the duct bank and the wall of the manhole/handhole. Vibrators shall be used when this portion of the envelope is poured to assure a seal between the envelope and the wall of the manhole/handhole.
- P. Partially Completed Duct banks: During construction, wherever a construction joint is necessary in a duct bank, without exception always prevent debris such as mud, sand, and dirt from entering ducts by providing suitable conduit plugs. Fit concrete envelope of a partially completed duct bank with reinforcing steel extending a minimum of twenty-four (24) inches back into the envelope and a minimum of twenty-four (24) inches beyond the end of the envelope. Provide one No. 5 bar in each corner, three (3) inches from the edge of the envelope. Secure corner bars with two No. 3 ties, spaced approximately four (4) inches apart. Restrain reinforcing assembly from moving during concrete pouring.
- Q. Conduit Plugs and Pull Rope: New conduit indicated as being unused or empty shall be provided with plugs on each end. Plugs shall contain a weephole or screen to allow water drainage. Provide a plastic pull rope having thirty-six (36) inches of slack at each end of unused or empty conduits.
- R. Duct bank and conduits shall slope down toward the manhole and handhole wall entry to allow ingress of water into the manhole/handhole and prevent collection of water inside the conduit.

Method of Measurement:

- A. Conduit and Duct Banks will be measured on a per "linear foot" basis. Measurement shall not occur until the task is complete, backfilled, proofed and pull-strings installed.
- B. Manholes and Handholes will be measured on a per "each" basis completely installed, fully connected to the incoming/outgoing duct banks and ready for the installation of cable.

Basis of Payment:

- A. Conduit and Duct Banks will be paid for at the Contract unit price bid. This price shall be full compensation for all labor, equipment, materials and tools required to perform this work. Associated surface restoration shall be included in this price.
- B. Manholes and Handholes will be paid for at the Contract unit price bid. This price shall be full compensation for all labor, equipment, materials and tools required to perform this work. Associated surface restoration, excluding pavement and sidewalks, shall be included in this price.
- C. Trench Excavation, Rock-in-Trench Excavation, No. 6 Crushed Stone, and Suitable Backfill Material shall be paid separately under the applicable Items.

Pay Item

4" PVC Duct Banks – 2 Ducts

Pay Unit

L.F.

ITEM #0020902A – LEAD COMPLIANCE FOR BUILDING RENOVATION AND DEMOLITION

Description:

Work under this item shall include activities impacting various materials containing or covered by lead paint and associated work by persons who are knowledgeable, qualified, and trained in the removal, treatment and handling of lead contaminated materials, including the transportation and disposal of non-hazardous lead construction and demolition solid waste containing or contaminated with lead, the recycling of metallic components covered with lead paint, and the subsequent cleaning of the affected environment. Lead paint includes paint found to contain **any** detectable amount of lead by Atomic Absorption Spectrophotometry (AAS) or X-Ray Fluorescence (XRF).

All activities shall be performed in accordance with, but not limited to, the current revision of the OSHA Lead in Construction Regulations (29 CFR 1926.62), the USEPA RCRA Hazardous Waste Regulations (40 CFR Parts 260 through 274), and the CTDEEP Hazardous Waste Regulations (22a-209-1 and 22a-449(c)).

The lead paint activity shall include the demolition/renovation, removal and/or disposal of building components coated with lead painted surfaces as identified on the Contract Plans and Specifications.

Deviations from these Specifications require the written approval of the Engineer.

Materials:

All materials shall be delivered to the job site in the original packages, containers, or bundles bearing the name of the manufacturer, the brand name and product technical description.

No damaged or deteriorating materials shall be used. If material becomes contaminated with lead, the material shall be decontaminated or disposed of as lead-containing waste material. The cost to decontaminate and dispose of this material shall be at the expense of the Contractor.

Fire retardant polyethylene sheet shall be in roll size to minimize the frequency of joints, with factory label indicating four (4) or six (6) mil thickness.

Six (6) mil polyethylene disposable bags shall have pre-printed OSHA/EPA/DOT labels and shall be transparent.

Tape (or equivalent) capable of sealing joints in adjacent polyethylene sheets and for the attachment of polyethylene sheets to finished or unfinished surfaces must be capable of adhering under both dry and wet conditions.

The cleaning agent detergent shall be lead specific, such as TriSodium Phosphate (TSP).

Any chemical stripper and chemical neutralizer to be utilized shall be compatible with the substrate as well as with each other.

Labels and warning signs shall conform to OSHA 29 CFR 1926.62, USEPA 40 CFR 260 through 274 and USDOT 49 CFR 172 as appropriate.

Any planking, bracing, shoring, barricades and/or temporary sheet piling, necessary to appropriately perform work activities shall conform to all applicable federal, state and local regulations.

Air filtration devices and vacuum units shall be equipped with HEPA filters.

Construction Methods:

(1) Pre-Abatement Submittals and Notices

A. Prior to the start of **any** work that will generate hazardous lead waste above conditionally exempt small quantities, the Contractor shall obtain from the Engineer a temporary EPA Hazardous Waste Generators ID number, in accordance with Item #0101143A – Handling and Disposal of Regulated Items, unless otherwise directed by the Engineer.

B. Fifteen (15) working days prior to beginning work that impacts lead paint, the Contractor shall submit the following to the Engineer:

1. Copies of all employee certificates, dated within the previous twelve (12) months, relating to OSHA lead awareness and hazard communication training and training in the use of lead-safe work practices.
2. Documentation from the Contractor, typed on company letterhead and signed by the Contractor, certifying that all employees listed therein have received the following:
 - a. medical monitoring within the previous twelve (12) months, as required in 29 CFR 1926.62;
 - b. biological monitoring within the previous six (6) months, as required in 29 CFR 1926.62;
 - c. respirator fit testing within the previous twelve (12) months, as required in 29 CFR 1910.134 (for those who don a tight-fitting face piece respirator).
3. Copies of state-approved certificates for the proposed non-hazardous construction and demolition (C&D) lead debris disposal facility and any concrete/wood or scrap metal recycling facilities.

No activity shall commence until a copy of all required submittals have been received and found acceptable to the Engineer. Those employees added to the Contractor's original list will be allowed to perform work only upon submittal of all required paperwork to, and review by, the Engineer.

Contractor shall provide the Engineer with a minimum of 48 hours notice in advance of scheduling, changing or canceling work activities.

(2) Lead Abatement Provisions

(a) General Requirements:

All employees of the Contractor who perform work impacting lead paint shall be properly trained to perform such duties.

All labor, materials, tools, equipment, services, testing, insurance (with specific coverage for work on lead), and incidentals which are necessary or required to perform the work in accordance with applicable governmental regulations, industry standards and codes, and these Specifications shall be provided by the Contractor. The Contractor shall be prepared to work all shifts and weekends throughout the course of this project.

Prior to beginning work, the Engineer and Contractor shall perform a visual survey of each work area and review conditions at the site for safety reasons. In addition, the Contractor shall instruct all workers in all aspects of personnel protection, work procedures, emergency evacuation procedures and use of equipment including procedures unique to this project.

The Contractor shall:

- Shutdown and isolate heating, cooling, and ventilating air systems to prevent contamination and particulate dispersal to the other areas of the building.

- Shut down and lock out electrical power, including all receptacles and light fixtures, when feasible. The use or isolation of electrical power will be coordinated with all other ongoing uses of electrical power at the site.

- Coordinate all power and fire alarm isolation with the appropriate representatives.

- When necessary, provide temporary power and adequate lighting and ensure safe installation of electrical equipment, including ground fault protection and power cables, in compliance with applicable electrical codes and OSHA requirements. The Contractor is responsible for proper connection and installation of electrical wiring.

Ladders and/or scaffolds to be utilized throughout this project shall be in compliance with OSHA requirements, and of adequate length, strength and sufficient quantity to support the scope of

work. Use of ladders/scaffolds shall be in conformance with OSHA 29 CFR 1926 Subpart L and X requirements.

Work performed at heights exceeding six feet (6') shall be performed in accordance with the OSHA Fall Protection Standard 29 CFR 1926 Subpart M including the use of fall arrest systems as applicable.

Electrical service may not be available at the site. Costs for supplying electrical service shall be the responsibility of the Contractor.

Water service may not be available at the site. The Contractor shall supply sufficient water for each shift to operate the wash facility/decontamination shower units in addition to the water needed at the work area.

Data for random lead testing conducted on surfaces throughout the buildings as well as hazardous waste characterization results are available from the Engineer for informational purposes only. Under no circumstances shall this information be the sole means used by the Contractor for determining the extent of lead painted materials. The Contractor shall be responsible for verification of all field conditions affecting performance of the work as described in these Specifications in accordance with OSHA, USEPA, USDOT and CTDEEP standards. Compliance with the applicable requirements is solely the responsibility of the Contractor.

Activity impacting lead painted surfaces shall be performed in a manner which minimizes the spread of lead dust contamination and generation of airborne lead.

The Engineer will provide a Project Monitor to oversee the activities of the Contractor. No activity impacting lead paint shall be performed until the Project Monitor is on-site. Environmental sampling, including ambient air sampling, TCLP waste stream sampling and/or dust wipe sampling, shall be conducted throughout the project as deemed necessary.

(b) Set-Up

The Contractor shall prepare a Regulated Area as follows:

In all areas where airborne exposures may exceed the OSHA PEL, post warning signs meeting the requirements of OSHA 29 CFR 1926.62 at each regulated area.

In addition, signs shall be posted at all approaches to regulated areas so that an employee may read the sign and take the necessary protective steps before entering the area. These signs shall read:

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING

Establish a Regulated Area, through the use of appropriate barrier tape, etc. and control unauthorized access into the area throughout the lead paint related activity.

Implement appropriate engineering controls such as critical barriers, poly drop cloths, negative pressure, local exhaust ventilation, wet dust suppression methods, etc. to prevent the spread of lead contamination from the Regulated Area.

For exterior work areas, the Contractor shall use a High Efficiency Particulate Air (HEPA) filtered vacuum dust collection system to remove any visible existing paint chips from the ground to a distance of 20' out from the base of the exterior surface scheduled for lead paint activity prior to commencement of work and extend a 6 mil polyethylene sheet drop cloth on the ground adjacent to the exterior surface scheduled for lead paint activity to contain debris/contamination.

The Contractor shall provide handwash facilities in compliance with 29 CFR 1926.51(f) and 29 CFR 1926.62 regardless of airborne lead exposure. This wash facility will consist, at least, of potable water, towels, soap, and a HEPA vacuum.

If air monitoring data by the Contractor or Project Monitor shows that employee exposure to airborne lead exceeds the OSHA PEL ($50 \mu\text{g}/\text{m}^3$), shower rooms must be utilized. The Shower Room shall be of sufficient capacity to accommodate the number of workers. One shower stall shall be provided for each eight (8) workers. Showers shall be equipped with hot and cold or warm running water through the use of electric hot water heaters supplied by the Contractor. Shower water shall be collected and filtered using best available technology and dumped down an approved sanitary drain. Shower stalls and plumbing shall include sufficient hose length and drain system or an acceptable alternate.

(c) Personal Protection:

The Contractor shall initially determine if any employee performing construction tasks impacting lead paint may be exposed to lead at or above the OSHA Action Level of 30 micrograms per cubic meter ($30 \mu\text{g}/\text{m}^3$). Assessments shall be based on initial air monitoring results as well as other relevant information. The Contractor may rely on historical air monitoring data obtained within the past 12 months under workplace conditions closely resembling the process, type of material, control methods, work practices and environmental conditions used and prevailing in the Contractors current operations to satisfy the exposure assessment requirements. Monitoring shall continue as specified in the OSHA standard until a negative exposure assessment is developed.

Until a negative exposure assessment is developed for the required tasks impacting lead paint, the Contractor shall ensure that all workers and authorized person entering the Regulated Area wear protective clothing and respirators in accordance with OSHA 29 CFR 1926.62. Protective clothing shall include impervious coveralls with elastic wrists and ankles, head covering, gloves and foot coverings. Sufficient quantities shall be provided to last throughout the duration of the

project.

Protective clothing provided by the Contractor and used during chemical removal operations shall be impervious to caustic materials. Gloves provided by the Contractor and used during chemical removal shall be of neoprene composition with glove extenders.

Respiratory protective equipment shall be provided and selection shall conform to 30 CFR Part 11, 29 CFR Part 1910.134, and 29 CFR Part 1926.62. A formal respiratory protection program must be implemented in accordance with 29 CFR Part 1926.62 and Part 1910.134.

(d) Lead Abatement Procedures

Ensure that the Competent Person is on the job at all times.

Do not begin abatement work until authorized by the Engineer, following a pre-abatement visual inspection by the Project Monitor.

The Contractor shall ensure proper entry and exit procedures for workers and authorized persons who enter and leave the Regulated Area. All workers and authorized persons shall leave the Regulated Area and proceed directly to the wash or shower facilities where they will HEPA vacuum gross debris from work suit, remove and dispose of work suit, wash and dry face and hands, and vacuum clothes. Do not remove lead chips or dust by blowing or shaking of clothing. Wash water shall be collected, filtered, and disposed of in accordance with federal, state and local water discharge standards.

No one shall eat, drink, smoke, chew gum or tobacco, or apply cosmetics while in the Regulated Area.

The following details the extent of each phase of operation designated for this project. Phase areas may be combined or divided at the direction of the Engineer. Proceed through the sequencing of the work phases under the direction of the Engineer.

Phase 1 – Non-metallic Components To Be Impacted

- **Lead paint was NOT identified on any non-metallic components on the Eastbound or Westbound platforms. The Engineer has characterized the projected non-metallic waste stream as non-hazardous construction and demolition (C&D) solid waste. Building structures waste stream characterized as non-hazardous shall be disposed of as non-hazardous construction and demolition (C&D) solid waste at an approved CTDEEP Solid Waste landfill.**

Phase 2 – Metal Components To Be Impacted

- **Lead paint has been identified on handrails on both the Eastbound and Westbound platforms. All demolition work impacting those materials shall be conducted within**

an established lead control (regulated) area with a remote handwash facility/decontamination system in accordance with OSHA Lead in Construction Standards. Engineering controls and work practices shall be utilized to prevent the spread of lead dust and debris beyond the work area and limit the generation of airborne lead. All steel and metal generated from the demolition of the structure shall be segregated and recycled as scrap metal at an approved facility. The recycling of scrap metal (regardless of lead paint concentration) is exempt from USEPA RCRA and CTDEEP Hazardous Waste Regulation.

The Contractor shall conduct exposure assessments for the tasks required which impact lead paint in accordance with OSHA 29 CFR 1926.62(d) and shall implement appropriate personal protective equipment until negative exposure assessments are developed.

Utilize appropriate engineering controls (e.g. wet methods) as directed by 29 CFR 1926.62 to control lead emissions and contamination.

Properly contain wastes containing lead paint for appropriate transport/disposal.

Stop all work in the regulated area and take steps to decontaminate non-work areas and eliminate causes of such contamination should lead contamination be discovered in areas outside of the regulated area.

Special Requirements:

1. Demolition:

- a. Demolish in a manner which minimizes the spread of lead contamination and generation of lead dust.
- b. Implement dust suppression controls, such as misters, local exhausts ventilation, etc. to minimize the generation of airborne lead dust.
- c. Segregate work areas from non-work areas through the use of barrier tape, poly criticals, etc.
- d. Clean up immediately after renovation/demolition has been completed

(e) Prohibited Removal Methods:

The use of heat guns in excess of 700 degrees Fahrenheit to remove lead paint is prohibited.

The use of sand, steel grit, water, air, CO₂, baking soda, or any other blasting media to remove lead or lead paint without the use of a HEPA ventilated contained negative pressure enclosure is prohibited.

Power tool assisted grinding, sanding, cutting, or wire brushing of lead paint without the use of cowled HEPA vacuum dust collection systems is prohibited.

Lead paint burning, busting of rivets painted with lead paint, welding of materials painted with lead paint, and torch cutting of materials painted with lead paint is prohibited. Where cutting, welding, busting, or torch cutting of materials is required, pre-remove the lead paint in the area affected.

Use of chemical strippers containing Methylene Chloride is prohibited.

Compressed air shall not be utilized to remove lead paint.

(f) Air Monitoring Requirements

1. The Contractor shall:

- a. Provide air monitoring equipment including sample filter cassettes of the type and quantity required to properly monitor operations and personnel exposure surveillance throughout the duration of the project.
- b. Conduct initial exposure monitoring to determine if any employee performing construction tasks impacting lead paint may be exposed to lead at or above the OSHA Action Level of 30 micrograms per cubic meter. Monitoring shall continue as specified in the OSHA standard until a negative exposure assessment is developed.
- c. Conduct personnel exposure assessment air sampling, as necessary, to assure that workers are using appropriate respiratory protection in accordance with OSHA Standard 1926.62. Documentation of air sampling results must be recorded at the work site within twenty-four (24) hours and shall be available for review until the job is complete.

2. The Project Monitor will:

- a. Collect air samples in accordance with the current revision of the NIOSH 7082 or 7702 Method of Air Sampling for Airborne Lead while overseeing the activities of the Contractor. Frequency and duration of the air sampling during abatement will be representative of the actual conditions at the site. The size and configuration of the project will be a factor in the number of samples required to monitor the activities and shall be determined by the Project Monitor.

As determined by AAS, XRF, or equivalent analysis, if air samples collected outside of the Regulated Area during abatement activities indicate airborne lead concentrations greater than original background levels or greater than 30 ug/m^3 , whichever is larger, an examination of the

Regulated Area perimeter shall be conducted and the integrity of barriers shall be restored. Cleanup of surfaces outside the Regulated Area using HEPA vacuum equipment or wet cleaning techniques shall be done prior to resuming abatement activities.

Abatement outside the initial designated work area(s) will not be paid for by the Engineer. The Contractor will be responsible for all costs incurred from these abatement activities.

(g) Clean-up and Visual Inspection:

Remove and containerize all lead waste material and visible accumulations of debris, paint chips and associated items.

During clean up the Contractor shall utilize rags and sponges wetted with lead-specific detergent and water as well as HEPA filtered vacuum equipment.

The Engineer will conduct a visual inspection of the work areas in order to document that all surfaces have been maintained as free as practicable of accumulations of lead in accordance with OSHA 29 CFR 1926.62(h). If visible accumulations of waste, debris, lead paint chips or dust are found in the work area, the Contractor shall repeat the cleaning, at the Contractor's expense, until the area is in compliance. The visual inspection will detect incomplete work, damage caused by the abatement activity, and inadequate clean up of the work site.

(h) Post-Abatement Work Area Deregulation:

Following the visual inspection, (and clearance testing if appropriate,) any engineering controls implemented may be removed and the Work Area deregulated.

A final visual inspection of the work area shall be conducted by the Competent Person and the Project Monitor to ensure that all visible accumulations of suspect materials have been removed and that no equipment or materials associated with the abatement project remain.

The Contractor shall restore all work areas and auxiliary areas utilized during work to conditions equal to or better than original. Any damage caused during the performance of the work activity shall be repaired by the Contractor at no additional expense to the Engineer.

(I) Waste Disposal/Recycling:

Non-metallic building debris waste materials tested and found to be non-hazardous Construction and Demolition (C&D) solid waste shall be disposed of properly at a CTDEEP approved Solid Waste landfill.

Metallic debris shall be segregated and recycled as scrap metal at an approved metal recycling facility. The Contractor shall submit to the Engineer all documentation necessary to demonstrate the selected recycling facility is able to accept lead-painted scrap metal.

Concrete, brick, etc. coated with any amount of lead paint cannot be crushed, recycled or buried on-site to minimize waste disposal unless tested and found to meet the CT RSR standards as “clean fill”. Only CTDEEP defined “clean fill” can be recycled on-site or sent to a recycling facility.

(j) Project Closeout Data:

1. Provide the Engineer, within thirty (30) days of completion of the project site work, a compliance package; which shall include, but not be limited to, the following:
 - a. Competent persons (supervisor) job log;
 - b. OSHA-compliant personnel air sampling data;
 - c. Completed waste shipment papers for non-hazardous lead construction and demolition (C&D) solid waste and/or concrete/wood/scrap metal recycling.

Method of Measurement:

No measurement will be made for the work in this Section. The completed work shall be paid as a lump sum.

Basis of Payment:

The lump sum price bid for this item shall include: services, materials, equipment, insurance, all permits, notifications, submittals, personal air sampling, personal protection equipment, temporary enclosures, incidentals, fees and labor incidental to activities impacting lead removal, treatment and handling of lead contaminated materials, and the transport and disposal of any non-hazardous lead construction and demolition (C&D) solid waste.

Final payment for lead abatement will not be made until all project closeout data submittals have been completed and provided to the Engineer. Once the completed package has been received in its entirety and accepted by the Engineer, final payment will be made to the Contractor.

Pay Item

Lead Compliance for Building Renovation

Pay Unit

Lump Sum

ITEM #0063521A – RAIL FACILITY UPGRADE (SITE NO.1)

Description:

Under this item, the Contractor shall complete the elements of work (architectural, structural, and communications) that make up the Major Lump Sum Item (MLSI), as depicted in this specification, the NOTICE TO CONTRACTOR – RAIL FACILITY UPGRADE (SITE NO. 1), the Contract Plans, and the CSI-formatted specifications. Refer to Form 816 Article 1.20 - 1.02.04 for additional information in this regard.

All the CSI-formatted specifications contained in the contract documents apply to the Major Lump Sum Item (MLSI).

The following elements of work constitute the MLSI:

- Removal and salvage of existing architectural elements, including platform benches, platform recycling bins, station signage, existing metal guard rail and handrails with associated hardware and connections, bridge plates, and existing lighting.
- Demolition of existing eastbound and westbound railroad concrete double-tee platforms, concrete ramps and stairs (full/partial), and temporary concrete double-tee platform.
- Modifications to existing platform piers, including concrete patching, crack repair, and bearing pedestals.
- New eastbound and westbound railroad platform sections, including bearings, structural steel and fasteners, precast platform panels, microsilica concrete overlay, platform waterproofing, detectable/tactile warning surfaces, joints, and rub rail.
- New stairways and ramps, including supporting substructure elements.
- Installation of architectural elements, including site furnishings, permanent shelter, temporary shelters, guard rail, hand rails, stair treads, joint sealants, and station door.
- Electrical work, including removing/replacing conduit, VMS, and PA speakers; removing and replacing light poles with LED retrofit; relocation of eastbound panel; and installation of unit heater in the station building.

Structure excavation, compacted structural fill, dewatering, excavate handling/disposal, and other related items of work associated with constructing the above MLSI elements items are not part of the MLSI.

Any work incidental to another bid item which is not specifically described or included in the bid item, but which is required for performance and completion of the work required under the Contract, shall be considered to be included under this item.

Materials:

All materials shall be as required by the Contract Plans and as described in the CSI-formatted Specifications that make up this MLSI.

Construction Methods:

All methods of construction shall conform to the requirements stipulated in the CSI-formatted Specifications that make up the MLSI.

Method of Measurement:

This item will be paid for at the contract lump sum price for “Rail Facility Upgrade (Site No. 1)” complete.

Basis of Payment:

This item will be paid for at the contract lump sum price for “Rail Facility Upgrade (Site No. 1)”, which price shall include all administrative and procedural requirements, material, equipment, labor, and work incidental thereto.

<u>Pay Item</u>	<u>Pay Unit</u>
Rail Facility Upgrade (Site No. 1)	L.S.

ITEM #0101143A – HANDLING AND DISPOSAL OF REGULATED ITEMS**Description:**

Work under this item shall include the management (handling and disposal) of regulated items and all associated work by persons who are employed by a CTDEEP permitted Spill Contractor and trained/certified in accordance with OSHA Hazard Communication regulations. Regulated items include hazardous and other materials and wastes, the disposal of which is restricted by Federal and/or State laws and regulations, and which may be a component of equipment or other items located on-site. Regulated items include those listed herein, or additional similar items identified on site by the Engineer. Work under this item does not include asbestos containing materials, lead paint, contaminated or hazardous soils.

Activities shall be performed in accordance with, but not limited to, the current revision of the USEPA & CTDEEP Hazardous Waste Regulations (40 CFR 260-282, 22a-209 and 22a-449(c)), USEPA PCB Regulations (40 CFR 761), USEPA Protection of Stratospheric Ozone (40 CFR 82), OSHA Hazard Communication (29 CFR 1910.1200), OSHA Hazardous Waste & Emergency Response Regulations (29 CFR 1910.120), USDOT Hazardous Materials Regulation (49 CFR 171-180), OSHA, RCRA, CERCLA, CAA, TSCA, and all other laws and regulations.

The work activities include the removal, handling, packing, labeling, transport, manifesting, and recycling or disposal of various regulated items at the Project site prior to beginning planned demolition activities.

The Contractor is solely responsible for verifying actual locations and quantities of the items with hazardous/regulated material/waste constituents and for their proper handling and disposal. The recycling or proper disposal, as appropriate, of all regulated items shall be completed prior to the initiation of any demolition activities.

Materials:

All materials shall be suitable for the management of regulated items and shall meet all applicable federal, state and local regulations. Such materials include, but are not limited to, proper containers, packing materials, labels, signs, shipping papers, personnel protective equipment (PPE) and spill kits.

Construction Methods:**(1) Allowable Disposal/Recycling Facilities**

Disposal facilities for RCRA-hazardous, TSCA-hazardous, Connecticut Regulated, and Universal wastes shall be chosen from among those listed below. No other facility shall be used for these types of wastes without the written approval of the Engineer.

Advanced Disposal Services
Greentree Landfill
635 Toby Road
Kersey, PA 15846
Phone: (814) 265-1744 Fax: (814) 265-8745
MSW, C&D, asbestos, PCB remediation waste <50 ppm, petroleum contaminated soils, nonhazardous solid wastes

Allied Waste Niagara Falls Landfill, LLC
5600 Niagara Falls Blvd.
Niagara, NY 14304
Phone: (716) 285-3344 Fax: (716) 285-3398
Non-hazardous waste, industrial solid waste, municipal sewage treatment sludge, contaminated soil & debris, asbestos waste, C&D debris, industrial process sludge

American Lamp Recycling, LLC
26 Industrial Way
Wappingers Falls, NY 12590
Phone: (845) 896-0058 Fax: (845) 896-1520
Mercury containing device, universal waste

Bridgeport United Recycling, Inc.
50 Cross Street
Bridgeport, CT 06610
Phone: (203) 334-1666 Fax: (203) 334-1439
RCRA & CRW waste oil, fuel, wastewater

Clean Earth of Carteret
24 Middlesex Ave.,
Carteret, NJ 07008
Phone: (732) 541-8909 Fax: (732) 541-8505
Concrete, brick, block, street sweepings, stone, rock, asphalt and petroleum contaminated soil

Clean Earth of Philadelphia, Inc.
3201 South 61 St.,
Philadelphia, PA 19153
Phone: (215) 724-5520 Fax: (215) 724-2939
Petroleum contaminated soil

Clean Earth of North Jersey, Inc. (aka CENJ)
115 Jacobus Ave,
South Kearny, NJ 07105
Phone: (973) 344-4004 Fax: (973) 344-8652
RCRA liquid and solid, asbestos

Clean Earth of Southeast Pennsylvania, Inc.
7 Steel Road,
Morrisville, PA 19067
Phone: (215) 428-1700 Fax: (215) 428-1704
Petroleum contaminated soil

Clean Harbors Environmental Services, Inc.
2247 South Hwy. 71,
Kimball, NE 69145
Phone: (308) 235-1012 Fax: (308) 235-4307
RCRA liquid, solid & sludge

Clean Harbors Environmental Services, Inc.
Cleveland Facility
2900 Rockefeller Ave.,
Cleveland, OH 44115
Phone: (216) 429-2401 Fax: (216) 883-1918
RCRA liquid: aqueous organic & inorganic wastewater

Clean Harbors of Baltimore, Inc.
1910 Russell St,
Baltimore, MD 21230
Phone: (410) 244-8200 Fax: (410) 752-2647
RCRA liquid: aqueous organic & inorganic wastewater

Clean Harbors of Braintree, Inc.
1 Hill Avenue,
Braintree, MA 02184
Phone: (781) 380-7134 Fax: (781) 380-7193
RCRA & TSCA liquid & solid

Clean Harbors of Connecticut, Inc.
51 Broderick Road,
Bristol, CT 06010
Phone: (860) 583-8917 Fax: (860) 583-1740
RCRA & CRW liquid

Clean Harbors of Woburn
(Murphy's Waste Oil Services, Inc.)
252 Salem Street,
Woburn, MA 01801
Phone: (781) 935-9066 Fax: (781) 935-8615
RCRA liquid: oil, oil/water mixtures; CRW oil filters, oily soil & debris, F001/F002 contaminated oils, antifreeze

Colonie Landfill (Waste Connections, Inc.)
1319 Loudon Rd,
Cohoes, New York 12047
Phone: (518) 783-2827 Fax: (518) 786-7331
Non-haz. wastes, special wastes, contaminated soil

Cranston Sanitary Landfill
1690 Pontiac Ave.
Cranston, RI 02920
Phone: (413) 552-3688 Fax: (413) 552-3330
Urban fill, contaminated soil, C & D debris, incineration ash (wood & coal), street sweeping and catch basin cleanings

Cumberland County Landfill
(aka Community Refuse Services
Managed by Interstate Waste Services)
135 Vaughn Road,
Shippensburg, PA 17257
Phone: (717) 729-2060 Fax: (717) 423-6822
Municipal solid waste, non-hazardous waste

Cycle Chem (aka General Chemical Corp.)
217 South First Street,
Elizabeth, NJ 07206
Phone: (908) 355-5800 Fax: (908) 355-0562
RCRA, TSCA liquid and solid

Envirite of PA
730 Vogelsong Road,
York, PA 17404
Phone: (717) 846-1900 Fax: (717) 854-6757
RCRA hazardous wastes

Environmental Quality Company:
Wayne Disposal Facility
(aka EQ Michigan Disposal Waste Treatment Plant
and Wayne Disposal Inc. Site #2)
49350 North I-94 Service Drive
Belleville, MI 48111
Phone: (734) 697-2200 Fax: (734) 699-3499
RCRA & TSCA liquid and solid

Environmental Quality Detroit Inc.
1923 Frederick Street,
Detroit MI 48211
Phone: (734) 329-8017 Fax: (313) 923-3375
RCRA & CRW liquid wastewater

Environmental Soil Management of New York,
LLC (ESMI of New York)
304 Towpath Road,
Fort Edward, NY 12828
Phone: (518) 747-5500 Fax: (518) 747-1181
Petroleum contaminated soil

Environmental Soil Management of NH
67 International Dr.,
Loudon, NH 03307
Phone: (603) 783-0228 Fax: (603) 783-0104
Petroleum contaminated soil

EnviroSafe Corporation Northeast (formerly Jones
Environmental Services, soon to be Triumvirate)
263 Howard Street,
Lowell, MA 01852
Phone: (978) 453-7772 Fax: (978) 453-7775
RCRA & TSCA liquid and solid

Hazelton Creek Properties, LLC*
(Hazelton Mine Reclamation Project)
280 South Church St.,
Hazelton, PA 18201
Phone: (570) 574-1010 Fax: (570) 457-3395
Fresh, brackish or marine dredge material, coal ash,
cement kiln dust, lime kiln dust, co-gen ash, regulated fill
*Please note that if this facility is to be used, each bin letter will require an additional 10 day (or more) waiting period on top of the 15 day lab period designated in the specs to allow for PADEP review.

Heritage Hazardous Waste Landfill (Heritage
Environmental Services, LLC)
4370 W County Rd 1275 N
Roachdale, IN 46172
Phone: (765) 435-2704 Fax: (315) 687-3898
Hazardous Wastes, Asbestos

Manchester Landfill
311 Olcott St.,
Manchester, CT 06040
Phone: (860) 647-3248 Fax: (860) 647-3238
Municipal solid waste, non-hazardous waste,
contaminated soil

Moretown Landfill
(Managed by Interstate Waste Services)
187 Palisades Park,
Waterbury, VT 05676
Phone: (802) 244-1100 x226
Fax: (802) 244-5133
Municipal solid waste, non-hazardous waste

Mostoller Landfill
(Managed by Interstate Waste Services)
7095 Glades Pike,
Summerset, PA 15501
Phone: (717) 729-2060 Fax: (814) 444-0127
Municipal solid waste, C&D debris, residual waste,
sewage sludge, incinerator ash, asbestos

Northampton Landfill
(Operated by Solid Waste Solutions, LLC)
170 Glendale Road,
Florence, MA 01062
Phone: (413) 498-0099 Fax: (413) 498-0267
Municipal solid waste, non-hazardous waste,
contaminated soil

Northeast Lamp Recycling, Inc.
250 Main Street,
East Windsor, CT 06088
Phone: (860) 292-1992 Fax: (860) 292-1114
CRW solid waste, mercury containing devices &
universal waste

Northland Environmental, LLC
(aka PSC Environmental Systems)
275 Allens Ave.,
Providence RI 02905
Phone: (401) 781-6340 Fax: (401) 781-9710
RCRA liquid and solid

Ontario County Landfill
(Managed by Casella Waste)
3555 Post Farm Road,
Stanley, NY 14561
Phone: (585) 526-4420 Fax: (585) 526-5459
Municipal solid waste, non-hazardous waste solid,
special wastes including asbestos, ash from
boilers/incinerators, contaminated soil, demo debris

Paradise Heating Oil, Inc.
Quimby Street,
Ossining, NY 10562
Phone: (631) 926-2576 Fax: (718) 294-2226
CRW waste oil liquid

Republic Environmental Systems (aka Philip
Services Corporation (PSC) Republic)
2869 Sandstone Dr.,
Hatfield PA 19440
Phone: (215) 822-8995 Fax: (215) 997-1293
RCRA & TSCA industrial solid & sludge, aqueous
waste, contaminated soil, PCB waste, oil & petroleum
waste, organic waste

Soil Safe, Inc.
378 Route 130, Logan Township,
Bridgeport NJ 08085
Phone: (410) 872-3990 x1120
Fax: (410) 872-9082
Soil contaminated with petroleum or metals, some
industrial waste solids

The Southbridge Recycling & Disposal Park
165 Barefoot Rd.
Southbridge, MA 01550
Phone: (508) 765-9723, (603) 235-3597
Fax: (508) 765-6812
MSW, non-hazardous C & D waste, contaminated soil
for cover

Stablex Canada, Inc.
760 Industrial Blvd.
Blainville Quebec J7C 3V4
Phone: (450) 430-9230 Fax: (450) 430-4642
RCRA liquid and solid, industrial wastes

Ted Ondrick Company, LLC
58 Industrial Road,
Chicopee, MA 01020
Phone: (413) 592-2566 Fax: (413) 592-7451
Petroleum contaminated soil

Tradebe Treatment & Recycling
136 Gracey Ave.
Meriden, CT 06451
Phone: (203) 238-8114 Fax: (203) 238-6772
RCRA, CRW wastewater, oil, hazardous waste fuels,
hazardous and non-hazardous waste water

Tunnel Hill Reclamation
2500 Township Road, 205 Route 2
New Lexington, OH 43764
Phone: (914) 713-0203 Fax: (914) 713-0672
Municipal solid waste, non-hazardous waste,
contaminated soils

Solid: MSW, non-hazardous waste, C&D, contaminated
soil for use as cover material under MADEP COMM-97
policy

Waste Management of NH

Upton Site Remediation, LLC
(formerly Upton Landfill)
Maple Avenue,
Upton, MA 01568
Phone: (413) 522-3688 Fax: (413) 522-3330
Contaminated soil for use as cover material under
MADEP COMM-97 policy

TLR III Refuse Disposal Facility
90 Rochester Neck Road, PO Box 7065
Rochester, NH 03839

Phone: (603) 330-2197 Fax: (603) 330-2130
Solid: MSW, C&D, PCB remediation waste (<50ppm),
virgin petroleum contaminated soil, CRW solid waste

Waste Management
RCI Fitchburg Landfill
Fitchburg Princeton Road,
Westminister, MA 01473
Phone: (978) 355-6821 Fax: (978) 355-6317

The category of material accepted by each facility listed above is for informational purposes only. The Contractor shall verify facility acceptance of each type of regulated item.

(2) Submittals

Thirty (30) days prior to commencement of work involving the management of regulated items, the Contractor shall submit to the Engineer for approval, the following documentation:

1. Copy of Spill Contractor Permit registration issued by the CTDEEP.
2. Hazard communication training for all employees performing this work.
3. Names of the treatment facilities, recycling facilities and/or disposal facilities the Contractor intends to use to receive each type of regulated item.
4. Hazardous Material Transporter USDOT Certificate of Registration for each transporter.
5. Hazardous Waste Transporter Permit for the State of Connecticut, the destination state(s), and all other applicable states for each transporter.
6. Request for an EPA Hazardous Waste Generators ID number, for use in manifesting hazardous waste above conditionally exempt small quantities (as applicable).

Contractor shall provide the Engineer with a minimum of 48 hours notice in advance of scheduling, changing or canceling work activities.

(3) Regulated Item Management Provisions

(a) General Requirements

The Contractor's OSHA Competent Person shall be in control on the job site at all times during hazardous material management work activities. This person must be capable of identifying existing hazards, possess the authority to implement corrective measures to reduce/eliminate the hazards, comply with applicable Federal, State and Local regulations that mandate work practices, and be capable of performing the work of this contract. All employees who perform regulated material management related work shall be properly trained and qualified to perform such duties.

All labor, materials, tools, equipment, services, testing, insurance, and incidentals which are necessary or required to perform the work in accordance with applicable governmental regulations, industry standards and codes, and these specifications, shall be provided by the Contractor.

Ladders and/or scaffolds shall be in compliance with OSHA requirements, and of adequate length, strength and sufficient quantity to support the scope of work. Use of ladders/scaffolds shall be in conformance with OSHA 29 CFR 1926 Subpart L and X requirements.

Work performed at heights exceeding six feet (6') shall be performed in accordance with the OSHA Fall Protection Standard 29 CFR 1926 Subpart M including the use of fall arrest systems as applicable.

Inventory data from investigative surveys throughout the buildings are included herein and are presented for informational purposes only. Under no circumstances shall this information be the sole means used by the Contractor for determining the quantities or extent of the regulated items to be managed. The Contractor shall be responsible for verification of all field conditions affecting performance of the work. The Contractor shall submit to the Engineer for concurrence any additional items not listed herein that it believes to be regulated items included under this item. However, compliance with applicable requirements is solely the responsibility of the Contractor.

The Engineer will provide a Project Monitor to monitor the activities of the Contractor and inspect the work required. Environmental sampling shall be conducted as deemed necessary by the Engineer. Spill areas shall be cleaned by the Contractor until accepted by the Engineer. The Engineer may sample the spill area to demonstrate Contractor compliance with an acceptable standard.

(b) Personnel Protection

Prior to commencing work, the Contractor shall provide hazard communication training to all employees as necessary in accordance with OSHA 29 CFR 1926.59 and 29 CFR 1910.1200 and instruct all workers in all aspects of personnel protection, work procedures, emergency procedures and use of equipment including procedures unique to this project. Worker health and safety protocols that address potential and/or actual risk of exposure to site specific hazards are solely the responsibility of the Contractor.

The Contractor shall provide respiratory protection that meets the requirements of OSHA as required in 29 CFR 1910.134 and 29 CFR 1926.1000. A formal respiratory protection program, including appropriate medical surveillance, must be implemented in accordance with OSHA

standards. The Contractor shall, as necessary, conduct exposure assessment air sampling, analysis and reporting to ensure the workers are afforded appropriate respiratory protection.

The Contractor shall provide and require all workers to wear appropriate personnel protective equipment, including protective clothing and respiratory protection, as required, within regulated work areas which exceed OSHA Personnel Exposure Limits (PELs) or when handling hazardous materials.

(c) Regulated Item Management Work Procedures

The Contractor shall not begin work until the Project Monitor is on-site.

Prior to beginning work on-site, the Contractor shall prepare waste characterization profile forms for each type of waste stream to be generated and forward such forms to the Engineer for review, approval and signature. Upon approval, the Contractor shall forward such forms to the appropriate disposal facilities for acceptance.

The Contractor shall utilize all appropriate engineering controls and safety and protective equipment while performing the work in accordance with OSHA, USEPA, USDOT, CTDEEP and Connecticut Department of Public Health DPH regulations.

The Contractor shall employ work practices so as to minimize the disturbance of the constituents in the regulated items, and prevent breakage and spills. In the event of a spill, the Contractor shall cordon off the area and notify the Engineer. The Contractor is responsible to have spills and the effected areas decontaminated to the acceptance of the Engineer by personnel trained in hazardous waste operator emergency response.

The Contractor shall carefully and properly remove, handle, pack, label and manifest all of the regulated items in waste containers specified and suitable to contain the waste in accordance with all federal and state regulations.

Prior to transportation and recycling and/or disposal, all proper USEPA, OSHA, CTDEEP and USDOT labels and placards shall be affixed to the waste containers and hazardous materials shipping papers such as waste manifests/bills of lading shall be completed.

Prior to demolition, properly remove, handle, pack, label, transport, manifest and recycle or dispose of the regulated items from those listed below:

The following hazardous/ regulated materials, wastes and items have been identified at the Noroton Heights Railroad Station, Darien, Connecticut.

- **Universal waste (UW) – used electronics, Hg lamps (signs) – Westbound side**
- **Universal waste (UW) – Hg lamps (sulfide bulbs) – East & Westbound side**
- **Connecticut Regulated Waste (CRW) – PCB Ballasts – East & Westbound side**

Upon discovery of any previously unidentified regulated items during demolition activities, the Contractor shall immediately notify the Engineer and work shall cease in that area until the Engineer can determine the extent of any impact and proper handling procedures are implemented.

(d) Waste Disposal

Efforts shall be made to recycle the constituents of the regulated items rather than dispose of them in accordance with the waste minimization efforts required under RCRA.

RCRA hazardous waste shall not be stored on the job site in excess of 90 calendar days from the accumulation start date.

Connecticut Regulated Waste shall not be transported to a RCRA or TSCA permitted facility for disposal, unless otherwise allowed by the Engineer in writing.

All non-RCRA hazardous waste materials, regulated waste materials and recyclable waste items shall be manifested separately from RCRA and TSCA hazardous waste, and documented properly on non-hazardous waste manifests, waste shipment records, bills of lading or other appropriate shipping papers for transportation to the recycling and/or disposal facility.

The Contractor shall prepare each lab pack list and shipping document (manifests, waste shipment records, bills of lading, etc.) with all of the required information completed (including types of waste, proper shipping name, categories, packing numbers, amounts of waste, etc.) in accordance with applicable federal and state regulations. The document will be signed by an authorized agent representing ConnDOT as the Generator for each load that is packed to leave the site.

The Contractor shall forward the appropriate original copies of shipping papers to the Engineer the same day the regulated items leave the project site.

All vehicles departing the site transporting hazardous materials shall display proper USDOT placards, as appropriate for the type of waste being transported.

(e) Project Closeout Documents:

Within thirty (30) days after completion of the on-site project work, the Contractor shall submit to the Engineer copies of the following completed documents:

1. Hazardous Waste Manifests
2. Waste Shipment Records/Bills of Lading
3. Recycling Receipts

Documents 1. through 3. must include the signature of an authorized disposal facility representative acknowledging receipt of hazardous materials.

Method of Measurement:

The work of "Handling and Disposal of Regulated Items" shall be provided for in accordance with Article 1.04.05 – Extra Work.

Basis of Payment:

The work of “Handling and Disposal of Regulated Items” shall be paid for in accordance with Article 1.04.05 – Extra Work, which price shall include the management, removal, handling, packing, labeling, transport, manifesting, recycling or disposal of the regulated constituents in the specific equipment/items scheduled for impact at the project site, and all equipment, materials, tools and labor incidental to the work.

Final payment will not be made until completed copies of all Manifest(s), Waste Shipment Records, Bills of Lading and/or Recycling Receipts have been provided to the Engineer. Once completed and facility-signed copies have been received in their entirety, the Engineer will make the final payment.

<u>Pay Item</u>	<u>Pay Unit</u>
Handling and Disposal of Regulated Items	Estimate

ITEM #0202455A – TEST PIT (ESTIMATED COST)

Description:

This work shall consist of the excavation of test pits where necessary to locate or examine utilities, subsurface structures, pipes, soils, groundwater, or any other obstacles or conditions.

This work shall consist of the satisfactory removal of all materials including, but not limited to, sawcutting pavements and sidewalks, pavement and sidewalk removal, excavation, shoring and bracing, water removal from within pit, stockpiling, satisfactory disposal of surplus or unsuitable material, backfilling, compacting, pavement repair, sidewalk repair, etc.

Test pits shall be dug as necessary for the Contractor to determine subsurface conditions as directed by the engineer. The contractor shall upon completion of “Non-Destructive Utility Investigations”, submit a work plan with locations of test pits for review by the engineer.

This work shall include the coordination with the affected utility companies or Metro-North. Any damage caused by the Contractor or Subcontractors, as determined by the Engineer, shall be corrected by the Contractor in accordance with these specifications.

Materials:

All materials shall be provided by the Contractor and shall meet the current standards of the affected service.

Construction Methods:

Coordinate excavation of test pits with respective utility company, or other owners having facilities in the vicinity. Check with "Call Before You Dig", 1/800/922-4455 before digging.

An estimate of cost shall be provided to the engineer prior to performing test pits.

Give sufficient notice and allow ample delay time for others to perform necessary work.

Notify the Owner’s Representative one-week in advance of digging each test pit.

Perform all work in conformance with applicable safety codes.

Sawcut pavement, sidewalk, curbs or other hard surface materials in neat and straight line. Excavate pits providing clean-cut vertical sides. Provide sheeting, bracing and dewatering wherever necessary.

Dig test pits ensuring that underground utilities or structures are not damaged. The Contractor shall excavate by hand methods to a depth of four (4) feet to insure that underground utilities or structures are not damaged. It shall be the Contractor's sole responsibility for any damages incurred during excavation operations. Any damages shall be repaired or replaced by the Contractor to the satisfaction of the Owner/Responsible Agency/Owner's Representative at the Contractor's own expense.

The Contractor shall measure and record the size, configuration, exact horizontal and vertical location of all utilities, pipes or other obstacles uncovered in the pits. Submit information in written or sketch form to the Owner's Representative and respective utility companies for review. Notify the Owner's Representative of any revealed conflicts which may require design revisions, relocations and/or adjustments as early as possible to avoid unnecessary delays. No work shall be started within areas of conflict until so authorized.

Protect each pit with steel plates, other coverings, fences, barriers or other appropriate materials as deemed necessary.

Do not backfill pits until authorized. Compact backfill materials to at least 95% of maximum density to the subgrade elevation or as otherwise directed.

The surface of test pit areas shall be restored to a condition equal or better than original as approved by the Owner's Representative.

Method of Measurement:

When previously approved by the Engineer, the item, Test Pit, will be measured for payment based on actual detailed monthly invoices for test pits performed. An estimate of cost shall be provided to the engineer prior to performing test pits.

Corrective work required repairing damage caused by the Contractor or its Subcontractors shall not be measured for payment.

Basis of Payment:

The sum of money shown on the Estimate and in the itemized proposal as "Estimated Cost" for this work will be considered the bid price even though payment will be made as described below. The estimated cost figure is not to be altered in any manner by the bidder. Should the bidder alter the amount shown, the altered figures will be disregarded and the original price will be used to determine the total amount for the contract.

The item, "Test Pit (Estimated Cost)", will be paid for at the actual detailed monthly account history for services approved by the Engineer, plus a 5% markup.

Payment will include all materials, equipment, labor and tools necessary for or incidental to the satisfactory completion of this work.

<u>Pay Item</u>	<u>Pay Unit</u>
Test Pit (Estimated Cost)	est.

ITEM #0219005A – SEDIMENTATION CONTROL COMPOSITE FILTER SOCK SYSTEM

Description:

Work under this item shall consist of providing and maintaining a sedimentation control composite filter sock system in the locations indicated on the contract plans.

Materials:

The material for this work shall consist of the following:

Composite Filter Sock: Composite Filter Sock shall meet the requirement of the test methods shown on the table below:

Property	Test Method	
Material	-	Polyester
Fabric	-	Knitted
Permittivity (min.)	ASTM D4491	5.5 sec ⁻¹
Puncture Resistance (min.)	ASTM D6241	1000 N
AOS (max.)	ASTM D4751	0.600 mm 30 U.S. Sieve
FOS (max.)	CAN/CGSB-148.1, M10-94	450 microns
Mass (relaxed)	ASTM D3887	3.0-3.9 oz/yd ²
Mass (applied minimum)		2.7-3.5 oz/yd ²
Thickness (min.)	ASTM D4491	24.0 mils
Permeability (K) (min.)	ASTM D4491	0.390 cm/sec
Burst Strength (min.)	ASTM D3887	830 kpa
Air Permeability (min.)	ASTM D737	700 ft ³ /ft ² /min
Water Flow Rate (min.)	ASTM D4491 (2" constant head)	300 gal/min/ft ²
Yarn Denier	-	150
Specific Gravity	-	1.3
Melt Temperature	-	450° F

Composite Filter Media: Compost used for compost filter sock filler material (filter media) shall be weed free and derived from a well-decomposed source of organic matter. The compost shall be produced using an aerobic composting process meeting CFR 503 regulations including time and temperature data. The compost shall be free of any refuse, contaminants or other materials toxic to plant growth. Non-composted products will not be accepted. Test methods for the items below should follow US Composting Council Test Methods for the Examination of Composting and Compost guidelines for laboratory procedures:

- A. PH – 5.0-8.0 in accordance with TMECC 04.11-A, “Electrometric pH Determinations for Compost”
- B. Particle size – 99% passing a 2 in (50mm) sieve and a maximum of 40% passing a 3/8 in (9.5mm) sieve, in accordance with TMECC 02.02-B, “Sample Sieving for Aggregate Size Classification”.
- C. Moisture content of less than 60% in accordance with standardized test methods for moisture determination.
- D. Material shall be relatively free (<1% by dry weight) of inert or foreign man made materials
- E. A sample shall be submitted to the Engineer for approval prior to being used and must comply with all local, state and federal regulations.

Construction Methods:

The compost filter sock shall be installed according to this specification, as shown on the plans or as directed by the Engineer.

- A. Compost filter socks should be installed parallel to the base of the slope or other disturbed area
- B. Stakes shall be installed through the middle of the compost filter sock on 8 ft centers, using 2 in (50mm) by 2 in (50mm) by 3 ft (1m) wooden stakes. In the event staking is not possible, i.e., when compost filter socks are used on pavement, heavy concrete blocks shall be used behind and on the compost filter socks to help stabilize during rainfall/runoff events.
- C. Staking depth for sand and silt loam soils shall be 12 in (300mm), and 8 in (200mm) for clay soils.
- D. Loose compost may be backfilled along the upslope side of the compost filter sock, filling the seam between the soil surface and the device, improving filtration and sediment retention.

Method of Measurement:

This work will be measured by the actual number of linear feet of installed and accepted Sedimentation Control Composite Filter Sock System. Measurement shall be made along the center-line of the system. It is intended that the system shall last for the duration of the adjacent staging schedules (Stage 1 and 2 for southside system and Stage 3 and 4 for the northside system. Repair and replacement of the system as required or directed by the Engineer shall not be measured for payment.

Basis of Payment:

The work under this Item will be paid for at the contract unit price per linear foot for “Sedimentation Control Composite Filter Sock System”, which price shall be include the installation; monitoring; replacement, removal and disposal of the system and surplus material. No payment shall be made for the clean out of accumulated sediment.

Pay Item

Sedimentation Control Composite Filter Sock System

Pay Unit

L.F.

ITEM #0219011A – SEDIMENT CONTROL SYSTEM AT CATCH BASIN

Description:

This work shall consist of furnishing, installing, cleaning, maintaining, replacing, and removing sedimentation control at catch basins at the locations and as shown on plans and as directed by the engineer.

Materials

Sack shall be manufactured from a specially designed woven polypropylene geotextile sewn by a double needle machine, using a high strength nylon thread. Sack shall be manufactured by one of the following or an approved equal:

Siltsack®

SI Geosolutions:

www.sigeosolutions.com

(800)621-0444

Dandy Sack™

Dandy Products Inc.

P.O. Box 1980

Westerville, Ohio 43086

Phone: 800-591-2284

Fax: 740-881-2791

Email: dlc@dandyproducts.com

Website: www.dandyproducts.com

FLeXstorm Inlet Filters

Inlet & Pipe Protection

24137 W. 111th St - Unit A

Naperville, IL 60564

Telephone: (866) 287-8655

Fax: (630) 355-3477

The sack will be manufactured to fit the opening of the catch basin or drop inlet. Sack will have the following features: two dump straps attached at the bottom to facilitate the emptying of sack and lifting loops as an integral part of the system to be used to lift sack from the basin. The sack shall have a restraint cord approximately halfway up the sack to keep the sides away from the catch basin walls, this cord is also a visual means of indicating when the sack should be emptied. Once the strap is covered with sediment, the sack should be emptied, cleaned and placed back into the basin.

Construction Methods:

Installation, removal, and maintenance shall be per manufacturer instructions and recommendations.

Method of Measurement:

Sediment Control System at Catch Basin will be measured as each installed, maintained, accepted, and removed. There will be no separate measurement for maintenance or replacement associated with this item.

Basis of Payment:

Sediment Control System at Catch Basin will be paid for at the contract unit price each complete in place and accepted, which price shall include all maintenance throughout construction, materials, equipment, tools, and labor incidental thereto.

ITEM #0601106A – CONCRETE STAIR LANDING

Description:

This item shall consist of concrete stair landings constructed on a gravel base course in the locations and to the dimensions and details shown on the plans or as ordered and in accordance with these specifications.

Materials:

Materials for this work shall conform to the requirements of CTDOT Form 816 Article M.03.02 for Class "F" Concrete.

Gravel for base shall conform to Article M.02.01 for granular fill.

Steel Reinforcement: Unless noted otherwise, all reinforcement, where and when specified, shall be four inches X four inches (4" x 4") - W4.0 Welded Wire Fabric and conform to A.S.T.M. "Standard Specifications for Welded Wire Fabric for Concrete Reinforcement".

Construction Methods:

1. **Excavation:** Excavation, including removal of any existing pavement (bituminous or concrete) and curbing, shall be made to the required depths below the finished grade, as shown on the plans or as directed. All soft and yielding material shall be removed and replaced with suitable material.

The Contractor shall establish the limits required to achieve grades for each landing prior to removal of existing pavement.

2. **Gravel Base:** The gravel or base shall be placed in layers not to exceed 6 inches in depth and to such a depth that after compaction it shall be at the specified depth below the finished grade of the walk. The base shall be wetted and rolled or tamped after the spreading of each layer.
3. **Forms:** Forms shall be of metal or wood, straight, free from warp and of sufficient strength to resist springing from the pressure of the concrete. If made of wood, they shall be of 2-inch surfaced plank except that at sharp curves thinner material may be used. If made of metal, they shall be of approved section and shall have a flat surface on the top. Forms shall be of a depth equal to the depth of the stair landing. Forms shall be securely staked, braced and held firmly to the required line and grade and shall be sufficiently tight to prevent leakage of mortar. All forms shall be cleaned and oiled or wetted before concrete is placed against them.

4. **Concrete:** The concrete shall be proportioned, mixed, placed, etc., in accordance with the provisions of Section 6.01 for Class "F" Concrete, except as modified herein. Concrete shall be cured in accordance with the provisions of Article 4.01.03 for Concrete Pavement.
5. **Finishing:** The surface of the concrete shall be finished with a wood float or by other approved means. The outside edges of the slab and all joints shall be edged with a 1/4-inch radius edging tool.
6. **Backfilling and Removal of Surplus Material:** The sides of the landing shall be backfilled with suitable material thoroughly compacted to permit the pavement repair as shown on the plans. All surplus material shall be removed and the site left in a neat and presentable condition to the satisfaction of the Engineer.

Method of Measurement:

This work will be measured for payment as follows:

1. **Concrete Stair Landing:** This work will be measured by the actual number of square feet of completed and accepted concrete stair landing.
2. **Excavation:** Excavation below the finished grade of the concrete stair landing, backfilling, and disposal of surplus material will not be measured for payment, but the cost shall be included in the price bid for the concrete stair landing. Excavation above the finished grade of the stair landing will be measured and paid for in accordance with Section 2.02.
3. **Gravel or Reclaimed Miscellaneous Aggregate Base:** This work will not be measured for payment, but the cost shall be considered as included in the price bid for the concrete stair landing.
4. **Steel Reinforcement:** This work will not be measured for payment but the cost shall be considered as included in the price bid for the concrete stair landing.

Basis of Payment:

Construction of a concrete stair landing will be paid for at the Contract unit price per square foot for "Concrete Stair Landing" complete in place, which price shall include all excavation as specified above, backfill, disposal of surplus material, curb removal when required for the concrete stair landing as shown on the plans, gravel base, steel reinforcement, equipment, tools, materials and labor incidental thereto.

Pay Item

Concrete Stair Landing

Pay Unit

s.f.

ITEM #0714999A – MONITORING STRUCTURES

Description:

Work under this item shall consist of providing horizontal and vertical monitoring of railroad tracks; existing catenary structures 434, 435, and 436; existing station building; the existing railroad platform piers which are remaining; and the existing pedestrian bridge (including its associated existing ramp structures), during the following construction activities:

- Demolition of the existing railroad platforms,
- Installation of the proposed railroad platform sections,
- Structure excavation activities.

In monitoring the existing catenary structures, special attention shall be paid to the attached existing conduits.

This work shall be performed as indicated in the Contract Drawings and as specified herein.

Materials:

The material for this work shall consist of the following:

Monitoring Points: These are to be used as targets in monitoring by conventional survey methods and shall have the following features:

- The target shall be the head of a 2-inch long masonry nail with an identification tag. The nail shall be manufactured from hardened, zinc-plated steel. The nail shall have ribbed threads along its shank and a conical point. It shall also have an indent in the center of its head to receive a surveyor's plumb bob.
- The identification tag shall be 2.5 inches in diameter by 0.1 inches thick with a punched number for identification. For rail road track monitoring, the masonry nail shall be placed through the central hole in the identification tag and driven into a rail tie such that the identification tag lies directly between the surface of rail tie and the head of the masonry nail.

Construction Methods:

All monitoring survey work shall be performed by a Land Surveyor registered in the State of Connecticut.

For rail road track monitoring:

- Monitoring points shall be located at 25-foot intervals along the centerline of all tracks within 50 feet of any of the construction activities identified under the “Description” section of this special provision.

For monitoring of the other station elements listed in this special provision (i.e. existing catenary structures 434, 435, and 436; existing station building; the existing railroad platform piers; and the existing pedestrian bridge and its associated existing ramp structures):

- At least two (2) monitoring points shall be located on each structure specified herein within 50 feet of any of the construction activities identified under the “Description” section of this special provision.

The proposed required monitoring point locations shall be shown on a plan provided by the Contractor. The Engineer reserves the right to modify the monitoring point layout.

Pre-construction activity survey: Prior to any construction activities (as identified under the “Description” section of this special provision) within 50 feet of any railroad tracks or other structures, perform a survey of the monitoring points -- determining the coordinates and elevations of the monitoring points.

Monitoring during construction activity: At the start, midday and end of daily construction activities, survey all monitoring points (determining coordinates and elevations) within 50 feet of any construction activities (as identified under the “Description” section of this special provision), to detect horizontal or vertical movements.

Establish the initial coordinates and elevation of each monitoring point to 0.1 inches or less.

The Contractor shall submit the monitoring point survey data to the Engineer within 24 hours of the survey data being obtained. When any reading indicating over 0.25 inches of movement (vertical or horizontal) is noted, the Contractor shall notify the Engineer and discuss possible remedial actions. When any reading indicating over 0.50 inches of movement (vertical or horizontal) is noted, the Contractor shall notify the Engineer and stop the construction activities identified under the “Description” section of this special provision until remedial actions have been implemented. The contractor shall submit for approval a work plan for remedial action to the engineer. No additional payment will be made for the remedial work required.

Method of Measurement:

The work covered under this Item shall be on lump sum basis and will not be measured for payment.

Basis of Payment:

The work under this Item will be paid for at the lump sum price for “Monitoring Structures”, which price shall be compensation for monitoring plans; furnishing, maintaining and installing monitoring points; monitoring; and survey data including all tools, labor, and incidentals thereto.

Pay Item

Monitoring Structures

Pay Unit

L.S.

ITEM #0728020A – STONE BALLAST

Description:

This item includes furnishing and installing ballast for track construction. This item also includes furnishing and installing miscellaneous ballast as shown on the plans and as directed by the Engineer.

Materials:

Submittals:

Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR - SUBMITTALS.

Compliance: Supplier's certification that the material delivered to the site is in compliance with the Specifications.

Samples: Submit as one representative sample and one sample of each new source of supply as requested by Engineer. Samples of not less than 150 lbs should be submitted. Field samples shall be secured in accordance with ASTM D75.

Test reports for testing specified herein.

References:

Comply with the latest provisions of Codes, Specifications, Standards, and recommended practices of the most recent edition and addenda thereto of:

AREMA: American Railway Engineering and Maintenance of Way Association,
Manual for Railway Engineering, Chapter 1, Part 2.

ASTM International (formerly American Society for Testing and Materials)

- A. ASTM C29 - Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate.
- B. ASTM C88 - Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
- C. ASTM C117 - Material finer than No. 200 Sieve in Mineral Aggregates by Washing.
- D. ASTM C127 - Specific Gravity and Absorption of Coarse Aggregate.

- E. ASTM C131 - Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine.
- F. ASTM C136 - Sieve or Screen Analysis of Fine and Coarse Aggregates.
- G. ASTM C142 - Clay Lumps and Friable Particles in Aggregates.
- H. ASTM C535 - Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- I. ASTM C702 - Standard Practice for Reducing Samples of Aggregate to Testing Size
- J. ASTM D75 - Standard Methods of Sampling Aggregates.
- K. ASTM D1556-00 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
- L. ASTM D 1557 – Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³).
- M. ASTM D2922 – Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
- N. ASTM D4318 - Determining the Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- O. ASTM D4791 - Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- P. ASTM E11 - Standard Specification for Wire Cloth and Sieves for Testing Purposes.

California Department of Transportation

California Test Method 217 - *Method of Test for Sand Equivalent* [Available at CalDOT website: http://www.dot.ca.gov/hq/esc/ctms/pdf/CT_217Nov99.pdf].

MNR: Metro-North Railroad

Publication MW-4 - Manual for Construction & Maintenance of Track.

Ballast Requirements:

Testing and inspection shall conform to the provisions as delineated in the AREMA Manual. Submit a quality control plan that addresses all requirements of this specification, including requirements and testing called out in referenced documents.

Submit qualifications of testing laboratory to perform required testing. Provide certified results of tests required by specifications. The Engineer reserves the right to witness the performance of tests.

Material not meeting the Specifications shall not be used in the work.

Furnish prepared ballast that is of crushed rock, hard, strong, angular, durable particles, containing no carbonates or slag, free from injurious amounts of deleterious substances.

Ballast shall have a minimum sand equivalent of 50 when measured by California Test 217.

Determination of weight per cubic yard shall be in accordance with ASTM C29.

All particles of the ballast shall have been broken by the crusher and have at least two broken surfaces.

All boulders which will pass through a 5-inch circular opening before crushing shall be rejected.

Type A ballast shall be crushed trap rock or granite. It shall: a) be composed of angular fragments which are clear and free from deleterious substance; b) have proper gradation; and c) meet all requirements of this specification. Additionally, ballast shall be in conformance with AREMA Chapter 1, Part 2 except as otherwise specified herein.

Ballast shall conform to the following scale when tested with laboratory sieves having square openings. (Sieves must conform to ASTM E11):

Size No.	Ballast Type	Nominal Size Sq. Openings	Amounts Finer Than Each Sieve (Sq. Opening Laboratory Sieve- Pct. by Wgt)						
			2"	1½"	1"	¾"	½"	⅜"	No.4
4	A	1½" - ¾"	100	90-100	20-55	0-15		0-5	
5	A	1" - ⅜"		100	90-100	40-75	15-35	0-15	0-5

Deleterious substances in ballast shall not be present in excess of the following amounts:

<u>Description:</u>	<u>Percent by Weight:</u>	<u>Method of Test</u>
Material finer than No. 200 Sieve	0.5 percent	ASTM C117
Clay lumps	0.5 percent	ASTM C142
Soft and friable pieces	3.0 percent	ASTM C142

Hardness shall be between 5.5 and 7.0 as measured on Moh Hardness scale.

Water absorption shall not exceed 1.2% when tested in accordance with ASTM C127.

Resistance to degradation shall be determined in accordance with ASTM C131 or ASTM C535. Materials having gradations containing particles retained on the 1 inch sieve shall be tested by ASTM C535. Materials having gradations with 100 percent passing the 1 inch sieve shall be tested by ASTM C131.

The Sieve Analysis shall be made in accordance with the ASTM C136.

Soundness shall be tested in accordance with ASTM C88. Average weighted loss shall not exceed 1.5 percent.

The percent of flat or elongated particles shall be determined in accordance with ASTM D4791. The dimension ratio shall be 1:3. Maximum allowable is 5 percent.

Be responsible for assuring ballast cleanliness. A suitable washing facility shall be provided at the quarry for this purpose. This facility shall consist of a high pressure spray over the ballast as it passes on the belt or other measures acceptable to the Engineer. Include washing procedures in the project quality control plan.

Prepared ballast shall be handled in such a manner that it is kept clean and free from segregation. It shall be only loaded into cars or trucks which are in good order, tight enough to prevent leakage and waste of material, and clean and free from rubbish or any substance which would foul the ballast.

The quality of stone for ballast from any quarry or new strata opened up, including its soundness, resistance to abrasion, chemical composition, absorption, impedance, hardness and weight per cubic foot, shall be determined prior to its acceptance at a testing laboratory selected by the purchaser. Each stratum or portion of quarry containing a variation of quality of stone shall be tested separately and not averaged. Quality tests and gradation tests shall subsequently be made from time to time as deemed necessary by the purchaser to control the quality and size of ballast furnished by the producer.

Sufficient visual observations, determinations of deleterious substances and analyses of gradation shall be made by the producer prior to shipment to assure compliance with these specifications.

Certify that ballast delivered to the Railroad is typical of that upon which specified tests have been made.

The selection of samples is as important as the laboratory testing; care shall be taken that the samples obtained show the true nature and conditions of the material to be examined.

Samples of all ballast and samples of stone at quarries for test to determine the acceptability of the source, as well as samples for quality control, shall be in accordance with ASTM D75 and C702.

Method of sampling shall be submitted. Sampling may be performed by the Engineer at his discretion. The quarry or producer may select samples for inspection or preliminary testing if such action is approved by the Engineer.

Samples of the finished product for gradation and other required tests shall be taken from each 1,000 tons of prepared ballast unless otherwise ordered by the Engineer. Samples shall be representative and shall weigh not less than 100 pounds. Where the acceptability of stone from a quarry is to be determined, a 150 pound sample consisting of pieces of approximately 6 by 6 by 4 inches should also be furnished.

No ballast shall be unloaded unless it has been accepted by the Engineer.

If material prior to, during or after being loaded, does not conform to specifications, stop operations until all faults have been corrected. Should ballast that does not meet specifications be unloaded, then payment will not be made to Contractor. Disposal and/or removal of defective material shall be done without any additional cost to the Department.

As it is impractical to inspect all ballast at quarry, the Engineer reserves the right to reject any car or truck load of ballast (whether previously inspected or not) that does not conform to specifications upon arrival at unloading site.

Handle prepared ballast at the production plant, during shipment, and at the work site so that it is kept clean and free of segregation.

Construction Methods:

Do not place ballast until the Engineer has approved the subgrade upon which the ballast is to be placed.

Place stone ballast to the limits and depths, and to the grade, shown on the plans, or as directed by the Engineer.

The ballast layer shall be thoroughly compacted until the surface is true and unyielding, displaying no deformation or movement under the compaction equipment. Compact ballast to 100-percent maximum density by vibratory compaction equipment specifically manufactured for compaction purposes, or self-propelled pneumatic-tired roller. Self-propelled, pneumatic-tired roller shall have a gross weight of 10- to 15-tons. Vibratory compactor shall have a weight of not less than 10-tons and be capable of applying a dynamic load of not less than 18,000-pounds at 1,300- to 1,500-cpm.

Tolerances: Leave top of ballast bed flat and level to within plus or minus 1-inch of the prescribed finished elevation across a 12-foot wide platform centered on the track centerline.

After installation of ballast layer, refrain from driving vehicles on the ballast layer that would foul or rut the ballast thereby potentially causing center-binding of ties. Replace any ballast that has become fouled by mud or fine materials at no cost to the Owner.

Determination of Thickness: The thickness shall be as indicated on the plans, or as ordered by the Engineer and within specified tolerances.

Measurements to determine the thickness will be taken by the Engineer at intervals of 500 feet or less, and shall be considered representative of the lane.

If a thickness measurement is taken and found deficient, the Engineer will take such additional measurements as he considers necessary to determine the longitudinal limits of the deficiency.

The Engineer may waive an occasional measurement outside the tolerances if in his judgment it is not representative of true conditions and providing that:

- (a) Other thickness measurements taken nearby for the course are within acceptable limits;
- (b) proper controls have been exercised by the Contractor; and
- (c) if there would be no impairment to the serviceability of the complete construction.

Method of Measurement:

All aggregate required for this work shall be weighed on scale furnished by and at the expense of the Contractor, except as otherwise permitted herein. The scales shall be of a type satisfactory to the Engineer and shall be calibrated and sealed, at the expense of the Contractor, as often as the Engineer may require.

Adjustments to compensation shall be made for deficiencies in plan depth and cross section as specified herein.

Provide certified scale tickets for each load of ballast delivered. Cars or trucks shall be weighed and such weights shall be forwarded with car/truck numbers to the Engineer.

Measurements shall be subject to the following provisions:

No adjustment of the quantity accepted for payment will be made where the thickness is within the allowable plus or minus tolerances.

Where the thickness exceeds that indicated on the plans by more than the prescribed tolerance, that material which is in excess of the total planned depth, plus the tolerance, will not be included for payment.

Areas represented by measurements deficient in thickness in excess of the allowable minus deviation shall be corrected at the Contractor's expense, or with written permission of the Engineer, the deficient areas may remain, and payment will be made at an equitable adjusted price based on weight per cubic yard.

An adjustment in quantity will be made in the materials placed beyond the horizontal limits indicated on the plans by deducting the computed weight of that material extending more than three inches beyond the horizontal plan dimensions.

Basis of Payment:

This work will be paid for at the contract unit price per ton for "Stone Ballast", complete in place, which price shall include all materials, tools, equipment and work incidental thereto.

<u>Pay Item</u>	<u>Pay Unit</u>
Stone Ballast	TON

ITEM #0901005A – BOLLARD

Description: This item shall consist of furnishing and installing a bollard in a concrete footing, of the type specified, at the location, to the dimensions and details as shown on the plans in accordance with these specifications, or as directed by the Engineer. The purpose of the bollard is to protect an electrical control box against incidental damage from a motor vehicle.

Material: Material for this work shall conform to the following requirements:

Concrete	Article M.03.02 Class "C" Concrete.
6" Steel Post	ASTM Schedule 80.
	Galvanized in accordance with ASTM A 123.

If the steel post is not galvanized it shall be painted. Painting shall consist of one primer coat conforming to Federal Specification TT-P-615d, Type II. There shall be two finished coats of paint. The final finish coat shall conform to Federal Specification TT-E-527 Air Drying, and the color shall be yellow conforming to Article M.07.01

Construction Methods: The steel post shall have an exposed length of 4'. The post shall be installed to a depth of 3', set in a concrete footing of at least 18" in diameter and 18" deep. In lieu of a footing, the entire hole shall be filled with concrete. If installed in a grass area, the top 6" of the hole shall be backfilled with a comparable material.

The post shall be filled with concrete. The top shall be rounded to a convex surface. No sharp edges, burrs, threads or other defects shall be exposed.

Method of Measurement: This work shall be measured for payment by the number of steel bollards installed and accepted in place.

Basis of Payment: This work will be paid for at the contract unit price each for "Bollard", which price shall include the steel post, concrete footing, painting, all necessary tools, equipment and labor required for installation. Concrete sidewalk shall be paid for by square foot at the contract price.

<u>Pay Item</u>	<u>Pay Unit</u>
Bollard	ea.

ITEM #0913069A – TEMPORARY 8’ CHAIN LINK FENCE
ITEM #0913984A – TEMPORARY PROTECTIVE FENCE

Description:

Work under this item shall consist of removing, transporting, storing and installing temporary chain link fencing and temporary protective fencing, of the type and height specified where indicated on the plans or as ordered and in conformity with these specifications. This item also includes the relocation of temporary chain link fence and temporary protective fence.

Materials:

Temporary chain link fence shall consist of 8-foot high surface mounted panels and shall include all required hardware as recommended by the manufacturer and/or supplier. Temporary Protective Fence shall consist of solid vinyl screening and shall include all required hardware as recommended by the manufacturer and/or supplier.

Construction Methods:

Furnish and install or relocate chain link fence panels, ties, and other materials for the height and locations specified in the contract documents. Place fence panels according to manufacturer’s recommendations. Secure in place through use of sand bags or other approved methods. Driving stakes or posts into the existing pavement shall not be allowed. Install privacy screening according to manufacturer’s instructions.

Temporary protective fence shall securely be attached to the temporary chain link fence using heavy-duty 6-ply reinforced hems (1-1/2” wide minimum) on all outside edges – sewn with 4-ply black polyester tread, and brass tooth grommets – spaced 18” apart on all sides

Method of Measurement:

Temporary 8’ Chain Link Fence and Temporary Protective Fence; will be measured for payment by the number of feet of completed and accepted fence, measured horizontally from outside-to-outside of terminal posts, as shown on the plans.

Basis of Payment:

The work will be paid for at the contract unit price per linear foot, for “Temporary 8’ Chain Link Fence” and “Temporary Protective Fence” of the type and height specified, complete in place, which price shall include all materials, equipment, tools and labor, incidental thereto. Relocation of Temporary 8’ Chain Link Fence shall only be paid for when fencing is initially placed for

each phase of the construction. Relocation of fencing as allowed during nightly shifts shall not be counted for payment.

Item No.	Item	Pay Unit
0913069A	Temporary 8' Chain Link Fence	l.f.
0913984A	Temporary Protective Fence	l.f.

ITEM #0971001A – MAINTENANCE AND PROTECTION OF TRAFFIC

Article 9.71.01 – Description is supplemented by the following:

The Contractor shall maintain and protect traffic as follows and as limited in the Special Provision "Prosecution and Progress":

HOLLOW TREE RIDGE ROAD, HEIGHTS ROAD, LEDGE ROAD, AND NOROTON AVENUE

The Contractor shall maintain and protect the existing number of lanes of traffic, including turning lanes, on Hollow Tree Ridge Road, Heights Road, Ledge Road, and Noroton Avenue.

PASSENGER DROP-OFF AREA AND PARKING LOT TO THE NORTH OF TRACKS

The Contractor shall maintain and protect the existing travel way and parking spaces within the passenger drop-off area to the north of the tracks.

Excepted therefrom will be those periods, during the allowable periods, when the Contractor is actively working, at which time the Contractor may close the western-most entrance to the one-way drive at Heights Road. At the same time, in order to protect and maintain the entering vehicular traffic flow to the parking lot located east of the drop-off area, the Contractor shall direct incoming vehicular traffic through the drop-off area exit (middle curb cut) located at Heights Road.

PARKING LOT TO THE SOUTH OF TRACK 4

The Contractor shall maintain and protect the existing travel way and parking spaces within the parking lot located to the south of Track 4. A number of existing paved parking spaces adjacent to the platform will be reserved for Contractor use during construction, at which time the Contractor will maintain a 24-foot minimum travel way between the edge of his work zone and the adjacent northern line of central parking spaces.

Excepted therefrom will be those periods, during the allowable periods, when the Contractor is actively working, at which time the Contractor may reserve during off-peak hours specific parking spaces in the parking lot for truck deliveries, and for the maneuvering of construction vehicles, as indicated in the contract plans. During this period, construction vehicles shall access and exit the parking area via the entrance/exit location at Ledge Road, at the southeastern corner of the parking lot. The Contractor shall be responsible for the method and materials used to reserve the allowable spaces. Costs for this work and associated materials shall be included in the cost for Maintenance and Protection of Traffic.

PEDESTRIAN ACCESS

Pedestrian access shall be maintained to all open platforms in accordance with the Maintenance and Protection of Traffic Plans, to allow for the safe passage of pedestrians during all construction phases with the following exception: The westbound platform will be closed for access during specific off-peak times. The access to the pedestrian overpass will be secured at different locations coming from the eastbound platform. A small section of sidewalk will also be constructed on the northern half of the station to allow platform access during staged construction. Please refer to pedestrian detour as detailed in the plans.

Construction barricades shall be provided along the railroad platforms at locations indicated in the contract drawings, for the protection of pedestrians during construction activities.

Temporary pedestrian crosswalks to provide pedestrian safety will be placed in two different locations in the parking lot to the south of track 4.

Article 9.71.03 - Construction Method is supplemented by the following:

SIGNING

The Contractor shall maintain all existing overhead and side-mounted signs throughout the project limits during the duration of the project. The Contractor shall temporarily relocate existing signs, temporary signs, and sign supports as many times as deemed necessary as shown on the Maintenance and Protection of Traffic Plans and as directed by the Engineer. The Contractor shall install temporary signs, sign supports, and foundations as called for in the Maintenance and Protection of Traffic Plans and as directed by the Engineer.

The temporary relocation of all signs and side-mounted supports shall be paid for under Item #0971001A – Maintenance and Protection of Traffic. The furnishing, installation, and removal of temporary side-mounted sign supports, and foundations shall also be paid for under Item #0971001A - Maintenance and Protection of Traffic. Unless they are adequately protected by guide rail or barrier, temporary side-mounted supports shall be breakaway supports conforming to specifications and details contained elsewhere in the contract.

Temporary signs, temporary overlay panels, and the temporary sign faces for side mounted and overhead signs shall be paid for under Item #1220027 - Construction Signs. The type of material, the type of sheeting, and the color of the sheeting for the temporary signs, temporary overlay panels, and temporary sign faces for side mounted and overhead signs shall be submitted to the Engineer for approval.

The Contractor may not install temporary sign posts in sidewalks. The Contractor must utilize existing sign posts, grassy areas or portable sign supports for the installation of temporary signing in areas of existing sidewalks.

CONSTRUCTION BARRICADES

At least 30 days prior to undertaking any work, the Contractor shall submit to the Engineer for review and approval all temporary construction barricades for use along the railroad platforms, at locations indicated in the contract drawings, for the protection of pedestrians during construction activities. No work shall begin until such plans have been approved by the Engineer.

REQUIREMENTS FOR WINTER

The Contractor shall schedule a meeting with representatives from the Department, including Maintenance and Traffic, and the Town to determine what interim traffic control measures the Contractor shall accomplish for the winter to provide safety to the motorists and permit adequate snow removal procedures. This meeting shall be held prior to October 31 of each year. The contractor, when ordered by the Engineer, shall remove snow and take care of icy conditions on restricted working areas, new and existing sidewalks on any part of the right-of-way within the limits of the project.

SIGNING PATTERNS

The Contractor shall erect and maintain all signing patterns in accordance with the traffic control plans contained herein. Proper distances between advance warning signs and proper taper lengths are mandatory.

SECTION 1. WORK ZONE SAFETY MEETINGS

- 1.a) Prior to the commencement of work, a work zone safety meeting will be conducted with representatives of DOT Construction, Connecticut State Police (Local Barracks), Municipal Police, the Contractor (Project Superintendent) and the Traffic Control Subcontractor (if different than the prime Contractor) to review the traffic operations, lines of responsibility, and operating guidelines which will be used on the project. Other work zone safety meetings during the course of the project should be scheduled as needed.
- 1.b) A Work Zone Safety Meeting Agenda shall be developed and used at the meeting to outline the anticipated traffic control issues during the construction of this project. Any issues that can't be resolved at these meetings will be brought to the attention of the District Engineer and the Office of Construction. The agenda should include:
 - Review Project scope of work and time
 - Review Section 1.08, Prosecution and Progress
 - Review Section 9.71, Maintenance and Protection of Traffic
 - Review Contractor's schedule and method of operations.

- Review areas of special concern: closed platforms, pedestrian detours.
- Open discussion of work zone questions and issues
- Discussion of review and approval process for changes in contract requirements as they relate to work zone areas

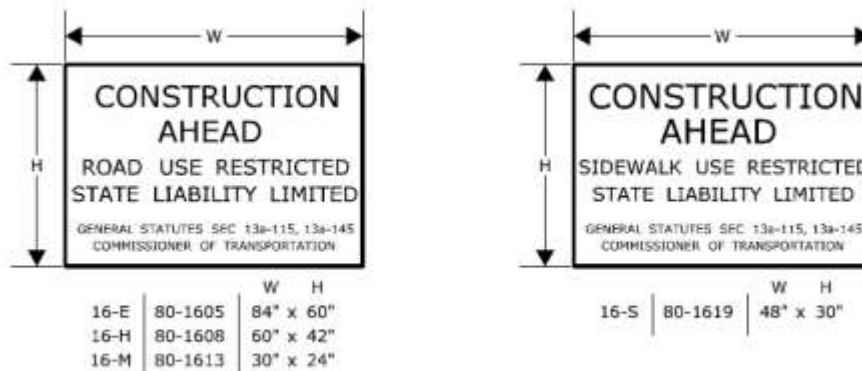
SECTION 2. GENERAL

- 2.a) If the required minimum number of signs and equipment are not available, the traffic control pattern shall not be installed.
- 2.b) Failure of the Contractor to have the required minimum number of signs, personnel and equipment, which results in the pattern not being installed, shall not be a reason for a time extension or claim for loss time.
- 2.c) In cases of legitimate differences of opinion between the Contractor and the Inspection staff, the Inspection staff shall err on the side of safety. The matter shall be brought to the District Office for resolution immediately or, in the case of work after regular business hours, on the next business day.

SECTION 3. INSTALLING AND REMOVING TRAFFIC CONTROL PATTERNS

- 3.a) The Contractor must adhere to using the proper signs, placing the signs correctly, and ensuring the proper spacing of signs.
- 3.b) Prior to installing a pattern, any conflicting existing signs shall be covered with an opaque material. Once the pattern is removed, the existing signs shall be uncovered.

SERIES 16 SIGNS



THE 16-S SIGN SHALL BE USED ON ALL PROJECTS THAT REQUIRE SIDEWALK RECONSTRUCTION OR RESTRICT PEDESTRIAN TRAVEL ON AN EXISTING SIDEWALK.

SERIES 16 SIGNS SHALL BE INSTALLED IN ADVANCE OF THE TRAFFIC CONTROL PATTERNS TO ALLOW MOTORISTS THE OPPORTUNITY TO AVOID A WORK ZONE. SERIES 16 SIGNS SHALL BE INSTALLED ON ANY MAJOR INTERSECTING ROADWAYS THAT APPROACH THE WORK ZONE. ON LIMITED-ACCESS HIGHWAYS, THESE SIGNS SHALL BE LOCATED IN ADVANCE OF THE NEAREST UPSTREAM EXIT RAMP AND ON ANY ENTRANCE RAMP PRIOR TO OR WITHIN THE WORK ZONE LIMITS.

THE LOCATION OF SERIES 16 SIGNS CAN BE FOUND ELSEWHERE IN THE PLANS OR INSTALLED AS DIRECTED BY THE ENGINEER.

SIGNS 16-E AND 16-H SHALL BE POST-MOUNTED.

SIGN 16-E SHALL BE USED ON ALL EXPRESSWAYS.

SIGN 16-H SHALL BE USED ON ALL RAMP, OTHER STATE ROADWAYS, AND MAJOR TOWN/CITY ROADWAYS.

SIGN 16-M SHALL BE USED ON OTHER TOWN ROADWAYS.

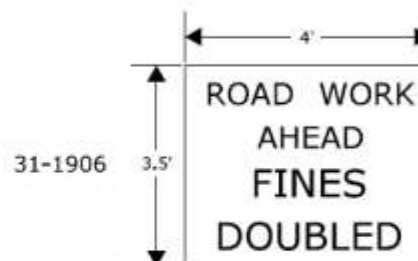
REGULATORY SIGN "ROAD WORK AHEAD, FINES DOUBLED"

THE REGULATORY SIGN "ROAD WORK AHEAD FINES DOUBLED" SHALL BE INSTALLED FOR ALL WORK ZONES THAT OCCUR ON ANY STATE HIGHWAY IN CONNECTICUT WHERE THERE ARE WORKERS ON THE HIGHWAY OR WHEN THERE IS OTHER THAN EXISTING TRAFFIC OPERATIONS.

THE "ROAD WORK AHEAD FINES DOUBLED" REGULATORY SIGN SHALL BE PLACED AFTER THE SERIES 16 SIGN AND IN ADVANCE OF THE "ROAD WORK AHEAD" SIGN.

"END ROAD WORK" SIGN

THE LAST SIGN IN THE PATTERN MUST BE THE "END ROAD WORK" SIGN.



SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN
REQUIRED SIGNS

CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED

Charles S. Harlow
PRINCIPAL ENGINEER

Charles S. Harlow
2012.06.05 11:35:43-0400

NOTES FOR TRAFFIC CONTROL PLANS

1. IF A TRAFFIC STOPPAGE OCCURS IN ADVANCE OF SIGN (A), THEN AN ADDITIONAL SIGN (A) SHALL BE INSTALLED IN ADVANCE OF THE STOPPAGE.
2. SIGNS (AA), (A), AND (D) SHOULD BE OMITTED WHEN THESE SIGNS HAVE ALREADY BEEN INSTALLED TO DESIGNATE A LARGER WORK ZONE THAN THE WORK ZONE THAT IS ENCOMPASSED ON THIS PLAN.
3. SEE TABLE 1 FOR ADJUSTMENT OF TAPERS IF NECESSARY.
4. IF THIS PLAN REMAINS IN CONTINUOUS OPERATION FOR MORE THAN 36 HOURS, THEN TRAFFIC DRUMS SHALL BE USED IN PLACE OF TRAFFIC CONES.
5. ANY LEGAL SPEED LIMIT SIGNS WITHIN THE LIMITS OF A ROADWAY / LANE CLOSURE AREA SHALL BE COVERED WITH AN OPAQUE MATERIAL WHILE THE CLOSURE IS IN EFFECT, AND UNCOVERED WHEN THE ROADWAY / LANE CLOSURE IS RE-OPENED TO ALL LANES OF TRAFFIC.
6. IF THIS PLAN REMAINS IN CONTINUOUS OPERATION FOR MORE THAN 36 HOURS, THEN ANY EXISTING CONFLICTING PAVEMENT MARKINGS SHALL BE ERADICATED OR COVERED, AND TEMPORARY PAVEMENT MARKINGS THAT DELINEATE THE PROPER TRAVELPATHS SHALL BE INSTALLED.
7. DISTANCES BETWEEN SIGNS IN THE ADVANCE WARNING AREA MAY BE REDUCED TO 100' ON LOW-SPEED URBAN ROADS (SPEED LIMIT < 40 MPH).
8. IF THIS PLAN IS TO REMAIN IN OPERATION DURING THE HOURS OF DARKNESS, INSTALL BARRICADE WARNING LIGHTS - HIGH INTENSITY ON ALL POST-MOUNTED DIAMOND SIGNS IN THE ADVANCE WARNING AREA.
9. A CHANGEABLE MESSAGE SIGN SHALL BE INSTALLED ONE HALF TO ONE MILE IN ADVANCE OF THE LANE CLOSURE TAPER.
10. SIGN (P) SHALL BE MOUNTED A MINIMUM OF 7 FEET FROM THE PAVEMENT SURFACE TO THE BOTTOM OF THE SIGN.

TABLE 1 - MINIMUM TAPER LENGTHS

POSTED SPEED LIMIT (MILES PER HOUR)	MINIMUM TAPER LENGTH FOR A SINGLE LANE CLOSURE
30 OR LESS	180' (55m)
35	250' (75m)
40	320' (100m)
45	540' (165m)
50	600' (180m)
55	660' (200m)
65	780' (240m)

METRIC CONVERSION CHART (1" = 25mm)

ENGLISH	METRIC	ENGLISH	METRIC	ENGLISH	METRIC
12"	300mm	42"	1050mm	72"	1800mm
18"	450mm	48"	1200mm	78"	1950mm
24"	600mm	54"	1350mm	84"	2100mm
30"	750mm	60"	1500mm	90"	2250mm
36"	900mm	66"	1650mm	96"	2400mm



SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN NOTES

CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED

Charles S. Hachow
PRINCIPAL ENGINEER

Charles S. Hachow
2012.06.05 15:59:35-0400

Article 9.71.05 – Basis of Payment is supplemented by the following:

The temporary relocation of signs and supports, the furnishing, installation and removal of any temporary supports, and the furnishing, installation and removal of the construction barricades along the railroad platforms, at locations indicated in the contract drawings, shall be paid for under the item “Maintenance and Protection of Traffic”. Temporary overhead sign supports and foundations shall be paid for under the appropriate item(s).

ITEM #1003925A – REMOVE EXISTING LUMINAIRE

Description: Work under this item shall consist of the removal and storage of existing 277/120v, 70w MH Model No. MA17-1-FM luminaire used for lighting platforms as shown on the plans or as directed by the Engineer and in conformity with these specifications.

Materials: All materials required for this work shall conform to the requirements of these specifications or the special provisions for the material in question; or if not so specified, they shall be of a quality satisfactory to the Engineer.

Construction Methods: Existing luminaire shall be carefully removed in such a manner as to safeguard all parts from damage or loss. The Contractor shall replace, at his own expense, all equipment which becomes damaged due to his operations.

Removal of existing luminaire shall be coordinated with the installation of these luminaires with LED Retrofit and lighting equipment so as to maintain the appropriate lighting levels and safety for those pedestrians using the railroad station. The Contractor shall furnish and install temporary lights or other equipment necessary to provide safe lighting levels as directed by the Engineer.

Luminaire and all other materials shall be removed in their entirety.

Equipment shall be removed in such a manner as to cause no hazard to pedestrians, traffic or property. If necessary, flagmen shall be used to halt traffic briefly while work is in progress.

All removed luminaires and all other materials shall be removed and stored in safe and secure place. Existing items or surfaces to remain which are damaged as a result of this Work shall be re-finished, repaired, or replaced in accordance with the appropriate sections of the Standard Specifications.

Method of Measurement: This work will be measured for payment by the number of luminaires removed; and stored.

Basis of Payment: This work will be paid for at the Contract unit price each for the "Remove Existing Luminaire" which price shall include all removals, all material, equipment and labor incidental to completion of this item.

<u>Pay Item</u>	<u>Pay Unit</u>
Remove Existing Luminaire	Each

ITEM #1003926A – REINSTALL LIGHT POLE

Description:

Work under this item shall consist of reinstalling the earlier removed light poles from the platforms. These poles shall be installed at their original locations from where these were dismantled per the staging plans and shown on the plans or as directed by these specifications.

Materials:

All the materials are the same as were removed previously from the platforms and stored. If for some unforeseen reasons, the work requires additional poles, the contractor shall arrange and install the new ones similar to the existing.

Construction Methods:

The stored poles shall be carefully brought to the site and reinstalled at their original locations indicated on plans. The poles shall be installed on the platform using the correct size of the bolts. The poles shall be exactly perpendicular to the platform surface. If any scratches come up on any of the poles during the installation, these shall be repaired and painted with matching paint to the satisfaction of the engineer.

Method of Measurement:

This work will be measured for payment by the number of light poles installed.

Basis of Payment:

Payment will be made by the number of light poles installed.

<u>Pay item</u>	<u>Pay unit</u>
Reinstall Light Pole	Each

ITEM #1003997A – REMOVE POLE

Description: Work under this item shall consist of the removal of poles used for lighting as shown on the plans or as directed by the Engineer and in conformity with these specifications.

Storing of removed poles in a Safe and Secure manner and no damage.

Materials: All materials required for this work shall conform to the requirements of these specifications or the special provisions for the material in question; or if not so specified, they shall be of a quality satisfactory to the Engineer.

Construction Methods: Existing pole shall be carefully removed in such a manner as to safeguard all parts from damage or loss. The Contractor shall replace, at his own expense, all equipment including removed poles which becomes damaged due to his operations.

Removal of existing pole shall be coordinated with the installation of these stored poles and lighting equipment so as to maintain the appropriate lighting levels and safety for those pedestrians using the railroad station. The Contractor shall furnish and install temporary lights or other equipment necessary to provide safe lighting levels as directed by the Engineer.

Poles and all other materials shall be removed in their entirety. For those lighting poles that have a speaker attached to it, remove and save the speaker and its associated wiring. New Speakers are to be installed upon installation of the stored pole and stored luminaire fitted with LED Retrofit.

Equipment shall be removed in such a manner as to cause no hazard to pedestrians, traffic or property. If necessary, flagmen shall be used to halt traffic briefly while work is in progress. All removed poles and all other materials shall be removed to a Safe and Secure place. Existing items or surfaces to remain which are damaged as a result of this Work shall be re-finished, repaired, or replaced in accordance with the appropriate sections of the Standard Specifications.

Method of Measurement: This work will be measured for payment by the number of poles removed.

Basis of Payment: This work will be paid for at the Contract unit price each for the "Remove Pole" which price shall include all removals, Safe Storage all material, equipment and labor incidental to completion of this item.

<u>Pay Item</u>	<u>Pay Unit</u>
Remove Pole	Each

ITEM #1005600A – LED LUMINAIRE

Description:

The work under this item shall consist of furnishing and installing light emitting diode (LED) Retrofit luminaires kits in the existing metal halide (MH) luminaires heads for the platform lighting. The Retrofit kits shall be of two kinds.

50 LA LED Retrofit constant wattage RKL-Philips Gardco or approved equal appropriate to use in pre-existing Philips Gardco Lighting Form 10 Round Semi-Spherical (MA) Cut-Off Luminaire, 17 inches diameter, Type IV Dist, 120V Model Number MA-17-1-FM-70MH-120-BRA-F-MF mounted on lighting poles on the platforms

RC-52-CNP-LED Retrofit constant wattage-60 watt low -profile adapter or approved equal for existing Lithonia Lighting 100W MH Prismatic Glass Reflector Canopy light luminaire model number KACM-100M-FP-120-LPISF

For eastbound platform shelter, furnish and install a new LED Luminaire TRAPEZOID-TLED-TC-48-VS-P-SURFACE 55W Total system watts and 102 lumens per watt LED LITE LOGIC LUMINAIRE OR Approved Equal.

Materials:

The LED Retrofit materials shall be delivered to the job site in original packages, containers bearing the name of the manufacturer, the brand name and product technical description. No damaged LED retrofit shall be used.

The delivery, storage, and handling shall be done in accordance with Form 816 Article 1.06.05 and Form 816 Article 1.20-1.06.03.

The LED retrofit kits should provide excellent performance with advanced LED thermal management technology. These features and the distinct styles of luminaires to provide outdoor area lighting and pedestrian scale lighting that is both energy efficient and aesthetically pleasing. The LED retrofit kits should be appropriate and compatible to the existing High quality Philips Gardco luminaires on the poles and Lithonia Lighting 100W MH Canopy Surface Light Fixtures. High performance Class 1 LED systems should offer the potential for energy savings up to 50 % when compared to HID systems.

The LED retrofit kits should provide extruded aluminum integral thermal radiation fins to provide the excellent thermal management so critical to long LED system life. The housing is to be fabricated using aluminium plate of appropriate thickness to provide strength and durability but also to act as a substantial heat sink for optimum performance and durability of LED light engine.

LED DRIVER ASSEMBLY: The retrofit kits to include an LED driver that accepts 120V through 277V, 50hz to 60hz, input. All retrofit kits would require removal of both the existing HID ballast assembly and the existing HID optical assembly. The retrofit kits to include a complete prewired LED driver assembly to replace the existing HID ballast assembly. For Form Ten Round LED area retrofit kits luminaires, the LED Driver is expected to be included in the optical system assembly.

Component-to-component wiring within the luminaire will carry no more than 80% of rated current and is listed by UL for use at 600 VAC at 302°F / 150°C or higher. Plug disconnects are listed by UL for use at 600 VAC, 15A or higher. Power factor is not to be less than 90%. Luminaires to consume 0.0 watts in the off state.

OPTICAL SYSTEMS: LED retrofit kits to include lensed LED arrays set to achieve IES Type I Type IV distributions. Individual LED arrays are to be replaceable. Optical systems are to be field rotatable. Luminaires to feature high performance Class 1 LED systems. Arrays are to be provided attached to the appropriate optic assembly based on the existing luminaire specified.

LABELS: When the LED retrofit is completed using the appropriate components supplied by Philips Gardco, then Philips Gardco luminaires retain UL or CUL (where applicable) Wet Location labels.

The LED should provide Reliability parameters as below:

PREDICTED LUMEN DEPRECIATION DATA

Ambient Temperature °C	Driver mA	L70 Hours ⁴
25 °C	350 mA	150,000
	530 mA	100,000
40 °C	350 mA	100,000
	530 mA	70,000

⁴Predicted performance derived from LED manufacturer's data and engineering design estimates, based on IESNA LM-80 methodology. L70 is the predicted time when LED performance depreciates to 70% of initial lumen output.

WARRANTY: The LED retrofit kits to feature a 5 year warranty, including a 5 year limited warranty covering the LED arrays and LED drivers.

Construction Methods:

Prior to the installation of the LED Retrofit Kits in the luminaires, the Contractor should obtain product data and test reports and provide the following submittals:

(1) Submittals

Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS.

Product Data: For each type of product indicated.

Qualification Data: For testing agency.

Field quality - control test reports.

Quality Assurance Submittals:

Manufacturer Certification Letter in accordance with NOTICE TO CONTRACTOR - POTENTIAL FOR ASBESTOS CONTAINING MATERIALS.

Source quality - control test reports.

Field quality - control test reports.

Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

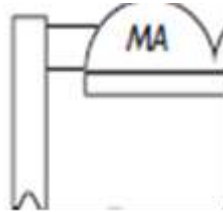
Comply with NFPA 70

(2) Lighting Requirements:

For platform lighting, the pre-existing Philips Gardco Lighting Form 10Round Semi-Spherical (MA) Cut-Off Luminaire, 17 inches diameter, Type IV Dist, 120V Model Number MA-17-1-FM-70MH-120-BRA-F-MF mounted on lighting poles on the platforms shall be fitted with RKL 50 LA LED Philips Gardco Lighting or approved equal retrofit kit per details below. This would require removal of both the existing HID ballast assembly and the existing HID optical assembly in the Philips Gardco Lighting Form 10Round Semi-Spherical (MA) Cut-Off Luminaire. RKL 50 LA LED Type 4 Retrofitted Luminaire shall have initial 6000 or better lumens output.

RKL 50 LA LED Retrofit For Form 10 Square PHILIPS GARDCO Luminaire

EXISTING LUMINAIRE

LED RETROFIT KIT	ORDER CODE	FOR USE WITH EXISTING PHILIPS GARDCO LUMINAIRES	LED WATTAGES	DISTRIBUTION
		ARM MT		
RKL Retrofit Kit - LED - Constant Wattage	C/M17	MA17	50LA	
				4 Type IV

For Canopy lighting, the existing fixtures for lighting under the Canopy of West Bound Platform are Lithonia Lighting Fixture Model KACM-100M-FP-120-LP1SF. These shall be fitted with LOUVERS LED Retrofit kit RC-52-CNP-LED Retrofit constant wattage -60 W SCOTTSDALE Low-Profile Adaptor Kit or approved equal with the following characteristics.

This would require removal of both the existing HID ballast assembly and the existing HID optical assembly in the existing Canopy Fixture.

“RC-52 –CNP – LED” Retrofit For LITHONIA Lighting CANOPY Light
100 W FIXTURES MODEL KACM-100M-FP-120-LP1SF

MODEL	DESC.	COLOR TEMP.	WATTS	LUMENS
RC-52-CNP-LED	LED Conversion Kit	5,000K	60	6,804

Platform Shelter Lighting: A new LED luminaire, TRAPEZOID-TLED-TC-48-VS-P-SURFACE 55W Total system watts and 102 lumens per watt LED LITE LOGIC LUMINAIRE OR Approved Equal should be furnished and installed in the Eastbound platform shelter .

Method of Measurement:

This work will be measured for payment by the number of LED luminaires of each kind installed, completed and accepted.

Basis of Payment:

This work will be paid for at the contract unit price each for each kind “LED Luminaire” of the type and the size specified, complete and accepted in place, which price shall include all materials including LED Retrofit kit for the existing luminaire,, driver, conductors, fuses identification sticker, connections, attachments, connections, and all labor, tools, equipment and work incidental thereto.

Pay Item
LED Luminaire

Pay Unit
Each

ITEM #1008183A – 3/4" PVC COATED CONDUIT**ITEM #1008184A – 1" PVC COATED CONDUIT****ITEM #1008186A – 4" PVC COATED CONDUIT****Description:**

The work under this item consists of furnishing and installing the 3/4", 1", and 4" PVC coated rigid metal conduit (RMC) as shown on the plans and specified herein for improvements at the rail line station. The rigid metal conduit shall meet the requirements of the National Electrical Code and the technical and safety recommendations of ANSI and IEEE.

Applicable Standards: Pertinent provisions of the following listed standards (latest edition) shall apply to the work of this Section, except as they may be modified herein, and are hereby made a part of this Specification to the extent required.

<u>Organization</u>	<u>Number</u>	<u>Title</u>
ANSI	C.80.1	Rigid Steel Conduit – PVC Coated
ANSI	C.80.3	Electrical Metallic Tubing – PVC Coated
NFPA	70	National Electrical Code
UL	1	Flexible Metal Conduit
UL	6	Rigid Metal Conduit
UL	50	Cabinets and Boxes
UL	67	Panelboards
UL	98	Test for Flammability of Plastic Materials for Parts for Devices and Appliances
UL	360	Liquid-Tight Flexible Steel Conduit
UL	467	Grounding and Bonding Equipment
UL	514A	Metallic Outlet Boxes
UL	514B	Fittings for Conduit and Outlet Boxes

Materials:

Materials, equipment, and devices shall, as a minimum, meet the requirements of UL where UL standards are established for those items and the requirements of the National Electrical Code (NEC), NFPA-70 and all state and local codes having jurisdiction.

Further, each item shall meet the requirements of these specifications and of the specifications and publications referenced herein. All items shall be new unless specified or indicated otherwise.

PVC Coated Rigid Metal Conduit: ANSI standard C80.1. Where to be embedded in concrete or run exposed, use rigid PVC coated galvanized steel conduit as manufactured by Wheatland Tube Company or Allied Tube & Conduit, or approved equal.

Flexible Metal Conduit: UL standard 1, PVC-coated steel only with liquid tight jacket.

Fittings for PVC Rigid Metal Conduit, Electrical Metallic Tubing, and Flexible Metal Conduit: UL standard 514. All ferrous fittings shall be PVC-coated per UL 514 as manufactured by Wheatland Tube Company or Allied Tube & Conduit, or approved equal.

Fittings for PVC coated galvanized rigid metal conduit shall be the threaded type. Split couplings are not acceptable. The conduits of all feeders and branch circuits shall be properly designated at all panelboards, switches and other equipment by an approved round yellow plastic tag, of 0.040- inch minimum thickness and one inch in diameter, Action craft Products, or approved equal. The lettering shall be black, 1/8-inch high. No. 18 morel wire, doubled, shall be used to secure the tag. A list of tag descriptions shall be submitted to the Engineer for approval before any lettering is done.

All conduits within enclosures shall be properly identified by Seton Name Plate Corporation "Setmark" markers, Brady Snap-On Pipe Markers, or approved equal. The lettering and color coding of the markers shall be black on an orange background or in conformance with the latest revision of the ANSI Z53.1 Scheme for Identification of Piping Systems.

UL standard 514, cadmium or zinc coated if of ferrous metal. Exterior outlet boxes and covers shall be coated with 40 mils of PVC, interiors shall be coated with 2 mil urethane and shall use Type 316 stainless steel screws as manufactured by Robroy Industries, Plastibond Series, or OCAL, Inc., OCAL Blue Series, or approved equal.

Clock outlet shall consist of an outlet box, a plaster cover where required, and a single receptacle with clock-outlet plate. The receptacle shall be recessed sufficiently within the box to allow the complete insertion of a standard cap, flush with the plate. A suitable clip or support for hanging the clock shall be secured to the top plate. Material and finish of the plate shall be as specified in paragraph 2.09, Device Plates.

Construction Methods:

The conduit shall be installed in the locations and to the dimensions shown on the plans or as directed by the Engineer. All conduit runs shall be installed in a neat and workmanlike manner in accordance with recognized trade practices. Trenching and backfilling of conduit shall conform to Article 10.01. All conduit shall be installed in strict accordance with the current NEC. Where conduit is to be capped, a commercial pipe or conduit cap shall be used.

An expansion fitting shall be used wherever required by an expansion joint in the structure. Upon completion of the work, all conduits shall be cleaned, swabbed and free from obstructions and burrs. For buried conduit, marking tape shall be installed in the trench at the depth and to the requirements as set forth in the Article 1.05.15. After all cable has

been installed, U.L. approved duct sealing compound shall be installed in the ends of all conduit which terminates in foundations, handholes, junction boxes and manholes.

- 1. Conduit Surface:** Beam clamps or conduit strips with back spacers shall be provided at intervals in accordance with the NEC. Expansion fittings shall be installed at all expansion joints. All surface mounted conduit on wood poles shall be bonded to a driven ground rod. Stand-offs shall be installed in accordance with serving utility company regulations.
- 2. Conduit in Trench:** Trenches shall be of the depth and cross section shown on the plans or as directed by the Engineer. All conduit shall have a minimum covering of 2 feet (600 millimeters).
- 3. Conduit Under Roadway:** Installations shall be such as to avoid pockets in runs. Conduit shall have a minimum cover of 2 feet (600 millimeters). Each end of conduit runs shall terminate with a cap in a concrete handhole as shown on the plans. The Contractor shall coordinate the placement of the conduit prior to the placement of the pavement.

Where conduit is to be installed under an existing roadway a trench shall be opened and conduit installed as shown on plans, or as directed by the Engineer. The trench shall be backfilled with suitable material and the surface shall be restored to original condition.

- 4. Conduit in Structure:** It shall be the Contractor's responsibility to coordinate the setting of all conduit in structure prior to pouring concrete. Expansion fittings shall be installed at all expansion joints. Where shown on the plans, outlet boxes with the conduits properly connected and conduit hanger inserts with proper sized nuts installed, shall be accurately and securely placed in the forms for concrete. Care shall be taken during the placing of the concrete around these boxes and inserts to consolidate the concrete thoroughly, preventing voids and honeycomb and to prevent any material displacement of the boxes or inserts. Sealed bonding bushing shall be provided at each conduit outlet in all boxes.
- 5. Conduit Under Slope Protection:** Conduit shall be installed in trench under bridge slope protection or between the slope protection and the edge of pavement at the locations and to the dimensions shown on the plans or as directed by the Engineer. The conduit shall have a minimum cover of two feet (600 millimeters) under finish grade and each end of the conduit shall extend 10 feet (3 meters) beyond the limits of the slope protection. All conduit shall terminate with a standard pipe cap and the trench shall be backfilled with suitable material. The Contractor shall coordinate the placement of the conduit prior to the placement of slope protection.

Unless indicated otherwise, all conduit shall be concealed within finished walls, ceilings, under platforms and floors. Conduit that will be visible after completion of project shall be installed parallel with or at right angles to ceilings, walls, and structural members.

Keep conduit at least 12 inches away from parallel runs of flues and steam or water pipes.

For Exterior Installations:

1. Conduit shall be supported by Type 316 stainless steel wall brackets, hangers, or ceiling trapeze. Fastenings shall be by Type 316 stainless steel wood screws or screw-type nails to wood; by Type 316 stainless steel toggle bolts on hollow masonry units; by concrete inserts or Type 316 stainless steel expansion bolts on concrete or brick; by Type 316 stainless steel machine screws, welded threaded studs, or spring-tension clamps on steel work. Threaded studs driven in by a powder charge and provided with lock washers and nuts may be used in lieu of expansion bolts or machine or wood screws. Type 316 stainless steel threaded C-clamps may be used on 40 mil PVC coated rigid steel conduit only. Conduits or pipe straps shall not be welded to steel structures. The load applied to fasteners shall not exceed one fourth of the proof test load. Fasteners attached to concrete ceiling shall be vibration and shock resistant. Holes cut to a depth of more than 1-1/2 inches in reinforced concrete beams or to a depth of more than 3/4 inch in concrete. Joints shall not cut the main reinforcing bars. Holes not used shall be filled. In partitions of light steel construction, sheet-metal screws shall be used. Exposed risers in wire shafts of multistory buildings shall be supported by Type 316 stainless steel U-clamp hangers at each floor level and at intervals not to exceed 10 feet.

For Interior Installations:

1. Conduit shall be supported by pipe straps, wall brackets, hangers, or ceiling trapeze. Fastenings shall be by wood screws or screw-type nails to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; by machine screws, welded threaded studs, or spring-tension clamps on steel work. Threaded studs driven in by a powder charge and provided with lock washers and nuts may be used in lieu of expansion bolts or machine or wood screws. Threaded C-clamps may be used on rigid steel conduit only. Conduits or pipe straps shall not be welded to steel structures. The load applied to fasteners shall not exceed one fourth of the proof test load. Fasteners attached to concrete ceiling shall be vibration and shock resistant. Holes cut to a depth of more than 1-1/2 inches in reinforced concrete beams or to a depth of more than 3/4 inch in concrete. Joints shall not cut the main reinforcing bars. Holes not used shall be filled. In partitions of light steel construction, sheet-metal screws shall be used. In suspended-ceiling construction, conduit shall be run above the ceiling. Spring steel fasteners may be used for lighting branch-circuit conduit supports in suspended ceilings in dry locations. Exposed risers in wire shafts of multi-story buildings shall be supported by U-clamp hangers at each floor level and at intervals not to exceed 10 feet.

Changes in direction of runs shall be made with symmetrical bends or cast-metal fittings. Field-made bends and offsets shall not be acceptable. Crushed or deformed conduit shall not be installed. Trapped conduits shall be avoided. Plaster, dirt, and trash shall be prevented from lodging in conduits, boxes, fittings, and equipment during construction. Clogged conduit shall be freed of all obstructions.

Conduits shall be fastened to all metal boxes and cabinets with two locknuts. Where insulated bushings are used and where bushings cannot be brought into firm contact with the box, at least two locknuts and bushing shall be used. Locknuts shall be the type with sharp edges for digging into the wall of metal enclosures. Bushings shall be installed on the ends of all conduits and shall be of the insulating type where required by the NEC.

Flexible connections of short length shall be provided for equipment subject to vibration, noise transmission, or movement and for all motors. Liquidtight flexible conduit shall be used in all exterior locations. A separate ground conductor shall be provided across all flexible connections.

Flexible metal conduit in general shall be the same size as the branch conduit. Where necessary for recessing devices, 1/2 inch flexible metal conduit may be used. In special circumstances and with approval of the Engineer, 3/8 inch flexible metal conduit may be used where permitted by Articles 350-3 and 410-67 of the NEC and in conformance with local codes.

Installation of the flexible metal conduit shall comply with Article 350 and applicable provisions of Articles 300, 333 and 346 of the NEC.

Approved conduit expansion joints shall be provided wherever conduit crosses a structural expansion joint, is attached between two separate structures, and wherever the conduit run is 100 feet or more in a single straight length. Joints shall be O.Z. Gedney Type DX, Crouse Hinds Type XD or approved equal.

Each piece of conduit installed shall be free from blisters and other defects. Each piece installed shall be cut square, taper reamed, and a coat of sealing compound applied to threads. Conduit connections shall be screwed tight with only incomplete threads exposed. All conduit joints shall be made with standard couplings and the ends of the conduit shall butt tightly into the couplings. In exposed work only, where standard couplings cannot be used, only Erickson couplings are permitted, or as otherwise acceptable to the Engineer.

Conduit threaded in the field shall have standard sizes and lengths.

The equivalent number of 90° bends in a single conduit run are limited to the following.

-	Runs in excess of 300 feet	0
-	Runs of 300 feet to 201 feet	1
-	Runs of 200 feet to 101 feet	2
-	Runs of 100 feet and less	3

Factory bent elbows or field bent elbows with approved tools may be used. Heating of conduit to facilitate bending is prohibited.

All exposed conduit shall be installed either parallel or perpendicular to structural members, unless impractical, and shall be grouped wherever possible. Conduit shall be attached to structural components with approved supports spaced a maximum of six (6) feet apart and shall form a neat rigid installation. Conduit supported from building walls shall be installed with at least 1/4 inch clearance from the walls to prevent the accumulation of dirt and moisture behind the conduit.

Conduit shall be protected immediately after installation by installing flat non-corrosive metallic discs and steel bushings, designed for this purpose, at each end. Discs shall not be removed until it is necessary to clean the conduit and pull wire and cable. Before wire or cable is pulled, insulated bushings shall be installed at each end of the conduit.

Where all thread nipples are used between fittings and electrical equipment, they shall be so installed that no threads are exposed.

Connections from rigid conduit to light fixtures, switches, etc., shall be made with short lengths of liquid-tight flexible PVC jacketed metal conduit equal to Type "LA" Electri-Flex, Type "ULTRATITE" Alfex Corporation, or Type "VA" Annaconda. These lengths shall be provided with appropriate connectors with devices which will provide an excellent electrical connection between equipment and the rigid conduit for the flow of ground current.

All threaded ends of conduits shall be coated with an approved conducting compound such as Thomas Betts prior to making up the point.

Conduit attachment to all electrical equipment, such as stainless steel junction boxes, pullboxes, switches, etc., shall be made with double steel locknuts. Threaded insulated bushings shall be used on the end of each conduit terminating in such equipment.

Conduits passing through sleeves in walls and floors shall be tightly caulked.

The use of two (2) locknuts and a grounding bushing will be required at all conduit terminations.

Conduit expansion fitting shall be equal to Crouse Hinds Type XD, OZ Gedney Type DX or equal for non-explosive areas.

Conduit penetrating fire rated wall shall be provided with fire seals equal to OZ Gedney Type CFS.

Conduits shall be supported with approved fittings. The support system shall not permit deflections to exceed 1/100 of the span.

All conduit and ducts, where indicated on the Contract Drawings, shall be caulked and sealed immediately after the wires and cables have been installed. The conduit bushings shall be thoroughly caulked with oakum, using wooden tools with rounded edges, and sealed with "Duxseal" waterproofing compound, Johns-Manville Corp. or approved equal. The compound shall be painted with one coat of approved insulated paint.

All conduits and their connections to electrical equipment shall be installed to make a continuous ground, except as indicated on the Contract Drawings, or as directed by the Engineer. All conduits connected to service end boxes, meter pans, panelboard boxes, current transformer cabinets, motor control center cabinets, automatic transfer switch enclosures, safety switch boxes, sheet metal boxes, troughs, etc., shall be installed on the outside of the box with electrogalvanized steel or malleable iron conduit locknuts, Thomas & Betts Corp. "42.56" series, or approved equal, and secured inside the box with electrogalvanized steel or malleable iron, 150 degree C. insulated grounding bushings, with solid copper alloy cradle lug type termination for copper ground conductor and hexagonal head screw (for conductors larger than No. 4) or slotted head screw (for No. 4 conductor or smaller), with a smooth spherical point and screw shank diameter equal in size to the largest diameter of copper conductor within the lug capacity, O.Z./GEDNEY Type IBC-L-BC series, or approved equal. Stranded copper conductors, with insulation colored dark green shall be used to bond the conduits to the boxes. No. 4/0 AWG, TYPE THWN ground wire shall be used on all service and distribution equipment, and panelboards.

Waterproof ferrules for electrical conduits shall be provided in the exterior walls, ceilings or floors of the enclosures. The Contractor shall submit drawings showing method of installation.

Ferrules shall consist of extra heavy galvanized steel pipe with flanges set in the wall or floor of the enclosures, waterproofed with brick in mastic in an approved manner. Sufficient membrane waterproofing shall be provided to properly lap over the waterproofing of the existing structure and to act as a base for the brick-in-mastic. Membrane waterproofing shall consist of three layers of treated cotton fabric mopped with asphalt.

Steel feed conduits shall be provided through ferrules. The space between the conduit and the ferrule shall be caulked with oakum and lead wool. The conduit shall be encased in concrete and shall extend to locations indicated on the Contract Drawings.

Boxes shall be provided in the wiring or raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways shall be of the cast-metal hub type coated with 40 mils of PVC when located in all wet locations, when surface mounted on outside of exterior surfaces, and when installed exposed up to 7 feet above interior floors and walkways. Each box shall have the volume required by the NEC for the number of conductors exposed in the box. Boxes for mounting lighting fixtures shall be not less than 4 inches square or octagonal except that smaller boxes may be installed as required by fixture configurations, as approved. Boxes installed for concealed wiring shall be provided with suitable extension rings or plastic covers, as required. Boxes for use in masonry-block or tile walls shall be square-cornered tile-type, or standard boxes having square-cornered tile-type covers. Cast metal PVC coated cast-metal boxes installed in all wet locations and boxes installed flush with the outside of exterior surfaces shall be gasketed.

Separate boxes shall be provided for flush or recessed fixtures when required by the fixture terminal operating temperature, and fixtures shall be readily removable for access to the boxes unless ceiling access panels are provided. Boxes and pendants for surface-mounted fixtures on suspended ceilings shall be supported independently of the ceiling supports, or adequate provisions shall be made for distributing the load over the ceiling support members in an approved manner.

For Exterior Installations:

1. Boxes and supports shall be fastened to wood with type 316 stainless steel wood screws or screw-type nails of equal holding strength, with Type 316 stainless steel bolts and expansion shields on concrete or brick, with Type 316 stainless steel toggle bolts on hollow masonry units, and with Type 316 stainless steel machine screws or welded studs on steel work. Threaded studs driven in by powder charge and provided with lockwashers and nuts may be used in lieu of wood screws, expansion shields, or machine screws. In open overhead spaces, PVC coated cast boxes threaded to raceways need not be separately supported except where used for fixture support; PVC coated cast-metal boxes having threadless connectors shall be supported directly from the building structure or by Type 316 stainless steel bar hangers. Where bar hangers are used, the bar shall be attached to raceways on opposite sides of the box and the raceway shall be supported with an approved fastener not more than 24 inches from the box. Penetration into reinforced concrete

members shall avoid cutting any reinforcing steel.

2. Boxes for use with raceway systems shall not be less than 1-1/2 inches deep except where shallower boxes required by structural conditions are approved. Boxes for other than lighting-fixture outlets shall be not less than 4 inches square except that 4-inch-by-2-inch boxes may be used where only one raceway enters the outlet. Telephone outlets shall be a minimum of 4 inches square by 1-1/2 inches deep.
3. Pull boxes of not less than the minimum size required by the NEC shall be constructed of PVC coated cast-metal boxes. Boxes shall be furnished with Type 316 stainless steel screw-fastened covers. Where several feeders pass through a common pull box, the feeders shall be tagged to indicate clearly the electrical characteristics, circuit number, and panel designation.

For Interior Installations:

1. Boxes and supports shall be fastened to wood with wood screws or screw-type nails of equal holding strength, with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel work. Threaded studs driven in by powder charge and provided with lockwashers and nuts may be used in lieu of wood screws, expansion shields, or machine screws. In open overhead spaces, cast boxes threaded to raceways need not be separately supported except where used for fixture support; cast-metal boxes having threadless connectors shall be supported directly from the building structure or by bar hangers. Where bar hangers are used, the bar shall be attached to raceways on opposite sides of the box and the raceway shall be supported with an approved fastener not more than 24 inches from the box. Penetration into reinforced concrete members shall avoid cutting any reinforcing steel.
2. Boxes for use with raceway systems shall not be less than 1-1/2 inches deep except where shallower boxes required by structural conditions are approved. Boxes for other than lighting-fixture outlets shall be not less than 4 inches square except that 4-inch-by-2-inch boxes may be used where only one raceway enters the outlet. Telephone outlets shall be a minimum of 4 inches square by 1-1/2 inches deep.
3. Pull boxes of not less than the minimum size required by the NEC shall be constructed of code-gauge galvanized sheet steel except where cast-metal boxes are required in locations specified above. Boxes shall be furnished with screw-fastened covers. Where several feeders pass through a common pull box, the feeders shall be tagged to indicate clearly the electrical characteristics, circuit number, and panel designation.
4. Where conduits are connected to boxes or equipment enclosures through drilled holes or full size knockout openings, electrical continuity for grounding shall be assured by the use of bonding type locknuts or copper grounding wedges having set screws made up tight to bushings. Where connections are at eccentric or concentric knockouts, jumper type grounding bushings and wire jumpers shall be installed. At pull and junction boxes having any box dimension in excess of 18 inches and

having a total of more than 4 conduit terminations, jumper type grounding bushings shall be installed on conduit ends and jumper wires shall be installed to bond all conduits and to bond conduits to boxes.

5. Should any structural difficulties prevent the setting of boxes at points shown on the plans, deviations therefrom as determined by the Engineer will be permitted and shall be made without additional cost.
6. A run of conduit between outlet and outlet, between fitting and fitting or between outlet and fitting shall not contain more than the equivalent of four quarter bends, including those bends located immediately at the outlet or fitting.
7. All junction boxes and pull boxes shall have identifying nameplates attached thereto, which when installed on sidewalk type boxes shall not extend above the surrounding concrete slabs.

Methods of Measurement:

Conduit will be measured for payment by the actual number of linear feet (meters) of the type and size installed and accepted. The measured length shall be from end to end along the centerline through all fittings.

Basis of Payment:

This work will be paid for at the Contract unit price per linear foot for "3/4", 1" and 4" PVC Coated Conduit."

This price shall include all materials required including expansion fittings, conduit fittings, locknuts, bonding bushings, bonding wire, hangers, clamps, duct seal, caps, inserts, equipment, tools, labor and work incidental thereto.

Trenching and backfilling shall be paid under Article 10.01.

No payment for trenching and backfilling will be made for conduit installed during construction under new pavement or in the fill area of new median barrier curb installations.

Pay Item

3/4" PVC Coated Conduit
1" PVC Coated Conduit
4" PVC Coated Conduit

Pay Unit

l.f.
l.f.
l.f.

ITEM #1008901A – REMOVE CONDUIT

Description:

Work under this item shall consist of removal of conduits:

- Used for lighting as shown on the plans or as directed by the Engineer and in conformity with these specifications.
- Used for Power Cable from the Utility Box at West end of E.B Platform to the Electric Panel Board in the shelter of E.B Platform.
- Used for Communication Cable of PA System and VMS System on Platforms.
- Any other identified conduit as directed by the Engineer.

Materials:

All materials required for this work shall conform to the requirements of these specifications or the special provisions for the material in question; or if not so specified, they shall be of a quality satisfactory to the Engineer.

Construction Methods:

Existing conduits shall be carefully removed together with all fittings and attachments in such a manner as to safeguard all parts from damage or loss. The Contractor shall replace, at his own expense, all equipment which becomes damaged due to his operations.

Removal of existing conduits shall be coordinated with the installation of new conduits and associated lighting, power and communication equipment so as to maintain the appropriate lighting levels, performance and safety for those pedestrians using the railroad station. The Contractor shall furnish and install temporary lights or other equipment necessary to provide safe lighting levels as directed by the Engineer.

Conduit, fittings, supports, and all other materials shall be removed in their entirety. Equipment shall be removed in such a manner as to cause no hazard to pedestrians, traffic or property. If necessary, flagmen shall be used to halt traffic briefly while work is in progress.

All removed conduit, fittings, supports and all other materials shall be removed to a suitable dump. Existing items or surfaces to remain which are damaged as a result of this Work shall be re-finished, repaired, or replaced in accordance with the appropriate sections of the Standard Specifications.

Method of Measurement:

This work shall be measured by the actual number of linear feet of conduit removed. The measured length shall be from end to end along the centerline through all fittings.

Basis of Payment:

This work will be paid for at the Contract unit price per linear foot for "Remove Conduit" which price shall include all removals, all material, equipment and labor incidental to completion of this item.

<u>Pay Item</u>	<u>Pay Unit</u>
Remove Conduit	If

ITEM #1014901A – REMOVE CABLE

Description:

Work under this item shall consist of phased removal of:

- Cables used for lighting.
- Power Cable from Utility Box on West end of EB platform.
- Twisted pair Communication Cable for PA Speakers.
- As shown on the plans or as directed by the Engineer and in conformity with these specifications.

Materials:

All materials required for this work shall conform to the requirements of these specifications or the special provisions for the material in question; or if not so specified, they shall be of a quality satisfactory to the Engineer.

Construction Methods:

Existing cables shall be carefully removed in such a manner as to safeguard all parts from damage or loss. The Contractor shall replace, at his own expense, all equipment which becomes damaged due to his operations.

Removal of existing cables shall be coordinated with the installation of new cables and lighting equipment so as to maintain the appropriate lighting levels and safety for those pedestrians using the railroad station. The Contractor shall furnish and install temporary lights or other equipment necessary to provide safe lighting levels as directed by the Engineer.

Removal of existing communication cable shall be coordinated with the installation of new communication cable and PA Speaker equipment; so as to maintain Public Announcement and information for the patrons using the railroad station. Cable and all other materials shall be removed in their entirety.

Equipment shall be removed in such a manner as to cause no hazard to pedestrians, traffic or property. If necessary, flagmen shall be used to halt traffic briefly while work is in progress.

All removed cable and all other materials shall be removed to a suitable dump. Existing items or surfaces to remain which are damaged as a result of this Work shall be re-finished, repaired, or replaced in accordance with the appropriate sections of the Standard Specifications.

Method of Measurement: The quantity of “Remove Cable” will be measured for payment by the actual number of linear feet of cable removed.

Basis of Payment: This work will be paid for at the Contract unit price per linear foot for “Remove Cable” which price shall include all removals, all material, equipment and labor incidental to completion of this item.

Pay Item

Remove Cable

Pay Unit

lf

ITEM #1020037A – TEMPORARY LIGHTING

Description:

Work under this item shall consist of providing the temporary lighting arrangements for the illumination of the non-staged part of the platform under construction for replacement of platform sections and other proposed works. Plan and execute the temporary lighting arrangements such that a minimum of Ten fc (10fc) of illumination is there on the platform.

Materials:

All the materials required for the temporary lighting such as wooden/ steel poles, Luminaires, wires, conduits if required are to be provided by the contractor. The contractor shall choose and arrange the source of electrical power-utility power or Generator for temporary lighting.

Construction Methods:

The poles with luminaire shall be erected as close to the platform as possible. The height of the luminaire from the top of platform surface shall be (ten) 10 feet and so placed that illumination level of the platform surface is a minimum. 10fc. The location of the temporary lighting poles to be such that these do not conflict or impact the re-installation of permanent poles on the platform. Proper grounding must be ensured for the temporary lighting arrangements.

Method of Measurement:

This work will be measured for payment as lump sum.

Basis of payment:

Payment will be made as lump sum.

<u>Pay Item</u>	<u>Pay Unit</u>
Temporary Lighting	Lump Sum

ITEM #1210101A – 4” WHITE EPOXY RESIN PAVEMENT MARKINGS

ITEM #1210105A – EPOXY RESIN PAVEMENT MARKINGS, SYMBOLS AND LEGENDS

SECTION 12.10 – EPOXY RESIN PAVEMENT MARKINGS, SYMBOLS AND LEGENDS is amended as follows:

Delete “SYMBOLS AND LEGENDS” from the title of the section.

SECTION 12.10.03 – Construction Methods is amended as follows:

Delete the entire sections titled “3. Performance and Warranty:” and “WARRANTY:” and replace them with the following:

3. Initial Performance: The retroreflectivity of the markings applied must be measured by the Contractor three (3) to fourteen (14) days after installation. A Certified Test Report (CTR), in accordance with Section 1.06.07, must be submitted to the Engineer no later than ten (10) days after the measurements are taken using the procedures and equipment detailed below:

Test Lots - The following test lots shall be randomly selected by the Engineer to represent the line markings applied:

Table 3.1: Line Test Lots

Length of line	Number of Lots	Length of Test Lot
< 1.0 mi. (1.5 km)	1	1000 ft. (300 m)
≥1.0 mi. (1.5 km)	1 per 1.0 mi. (1.5 km)	1000 ft. (300 m)

Measurement Equipment and Procedure

Portable Retroreflectometer

1. Skip line measurements shall be obtained for every other stripe, taking no more than two readings per stripe with readings no closer than 20 in. (0.5 m) from either end of the marking.
2. Solid line test lots shall be divided into ten sub-lots of 100 ft. (30 m) length and measurements obtained at one randomly select location within each subplot.
3. For symbols and legends, 10 percent of each type shall be measured by obtaining five (5) measurements at random locations on the symbol or legend.
4. The Apparatus and Measurements shall be made in accordance with ASTM E1710 (Standard Test Method for Measurement of Retroreflective Pavement Marking Materials with CEN-Prescribed Geometry Using a Portable Retroreflectometer) and evaluated in

accordance with ASTM D7585/D7585M (Standard Practice for Evaluating Retroreflective Pavement Markings Using Portable Hand-Operated Instruments).

Mobile Retroreflectometer

1. Calibration of the instruments shall be in accordance with the manufacturer's instructions.
2. Retroreflectivity shall be measured in a manner proposed by the Contractor and approved by the Engineer. The basis of approval of the test method will be conformance to a recognized standard test method or provisional standard test method.

The measurements shall be obtained when the pavement surface is clean and dry and shall be reported in millicandellas per square foot per foot candle - mcd/ft²/fc (millicandelas per square meter per lux (mcd/m²/lux)). Measurements shall be obtained sequentially in the direction of traffic flow.

Additional Contents of Certified Test Report

The CTR shall also list:

- Project and Route number
- Geographical location of the test site(s), including distance from the nearest reference point.
- Manufacturer and model of retroreflectometer used.
- Most recent calibration date for equipment used.
- Grand Average and standard deviation of the retroreflectivity readings for each line, symbol or legend.

Initial Performance:

In order to be accepted, all epoxy resin pavement markings must meet the following minimum retroreflectivity reading requirement:

White Epoxy: minimum retroreflectivity reading of 400 mcd/ft²/fc (mcd/m²/lux)

At the discretion of the Engineer, the Contractor shall replace, at its expense, such amount of lines, symbols and legends that the grand average reading falls below the minimum value for retro-reflectivity. The Engineer will determine the areas and lines to be replaced. The cost of replacement shall include all materials, equipment, labor and work incidental thereto.

CSI SPECIFICATIONS

INDEX OF CSI FORMATTED SPECIFICATIONS

NOROTON HEIGHTS RAILROAD STATION PLATFORM REPLACEMENT DARIEN, CONNECTICUT STATE PROJECT NO. 0301-0170

DCD SUBMISSION

NOTE: All the CSI-formatted Specifications listed below make up the Major Lump Sum Item (MLSI) and are included under the Form 816 ITEM #0063521A – RAIL FACILITY UPGRADE (SITE NO.1).

DIVISION 01 – GENERAL REQUIRMENTS

- 01 53 05 TEMPORARY PLATFORM
- 01 53 10 TEMPORARY SUPPORT SYSTEM
- 01 56 23 TEMPORARY BARRICADES AND GUARDRAIL

DIVISION 02 – EXISTING CONDITIONS

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SECTION 01 53 05 - TEMPORARY PLATFORM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Under this item the Contractor shall remove, temporarily store as required, and temporarily re-install, at a new location, one of three pre-approved reusable existing concrete double-tee platform sections, as shown on the plans or as directed by the Engineer.
- B. The Contractor shall perform and submit to the Engineer a condition assessment of the three pre-approved reusable platform sections. The platform section found to be in the most satisfactory condition by the Engineer shall be used for the temporary platform.
- C. Under this item the Contractor is also responsible for identifying and preparing a temporary storage location for the temporary platform.
- D. The re-installation of the platform shall consist of placing the existing platform section onto new temporary platform supports, levelling the unit as required with metal shims, and installing a temporary silicone expansion joint system between the temporary platform section and the longitudinal edge plate of the adjacent proposed platform section, as shown on the plans or as directed by the Engineer.
- E. The information shown on the plans pertaining to this work conveys the assumptions made by the designer and is for information only. The Contractor shall be responsible for selecting the means and methods for construction.
- F. The Contractor shall also submit information in accordance with CTDOT Form 816 Article 1.05-02-3, and as noted below, and shall include design calculations, construction schematics, construction sequences and procedures to the Engineer for review.
- G. The Contractor is to take measures to minimize noise in all project areas, as required under CTDOT Form 816: Section 1.10 – Environmental Compliance and Article 1.10.05 – Noise Pollution.
- H. The temporary guardrail and attachments shall be furnished and constructed in accordance with the details shown on the plans and the CSI-formatted specification SECTION 01 56 23 - TEMPORARY BARRICADES AND GUARDRAIL.
- I. The final removal and satisfactory disposal of the temporary platform section (including the temporary silicone expansion joint system) shall be performed in accordance with the details shown on the plans and under the CSI-formatted specification SECTION 02 41 19 – REMOVAL OF EXISTING MASONRY.

1.1 SUBMITTALS

TEMPORARY PLATFORM
0301-0170

01 53 05 - 1

- A. **Working Drawings:** The Contractor shall, at least 30 calendar days prior to the start of construction of the temporary platform work, submit to the Engineer, for his review and approval, detailed temporary platform working drawings and computations of his proposal, in accordance with the requirements of CTDOT Form 816 Article 1.5.02 and the NOTICE TO CONTRACTOR – SUBMITTALS. At a minimum, the Working Drawings shall address the following:
1. The temporary storage location for the temporary platform, including the travel way to and from the storage site.
 2. Means of handling and transporting the temporary platform to and from the temporary storage location without damaging or overstressing the unit.
 3. Handling plans for the temporary platform, including lifting inserts, hardware, or devices and locations on the working drawings for Engineer's approval, including supporting calculations, type, and amount of any additional support required for lifting and transporting the temporary platform.
 4. Codes and regulations of the jurisdictional authorities, including Metro-North, shall apply.
 5. The temporary platform supports at both the storage location and re-installation location shall be designed to accommodate applicable load combinations in accordance with the latest *American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures* (ASCE7-10) and *AASHTO Standard Specifications for Highway Bridges*.
 6. The design of temporary platform supports at both the storage location and re-installation location shall be done using the service load method in accordance with the latest editions of the applicable *American Concrete Institute* (ACI) and *American Institute of Steel and Construction* (AISC) codes.
 7. In case of conflicts between referenced standards and these Specifications, the most stringent requirements, as determined by the Engineer, shall govern in each instance.
 8. The Contractor shall make all field measurements necessary to complete the work and shall submit copies of all field measurements for review by the Engineer.
 9. The working drawings and calculations must be prepared, stamped, and signed by a Professional Engineer licensed in the State of Connecticut.
 10. The furnishing of such plans, methods and calculations shall not serve to relieve the Contractor of his responsibility for the safety of the work and the successful completion of the project. The Contractor's proposal must meet all requirements established in regulatory permits for the project and must also conform to the requirements of CTDOT Form 816 Section 1.10.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The materials for this work, including metal shims and temporary platform supports, shall meet the requirements of CTDOT Form 816 Sections M.03 and M.06, as applicable, and shall be of satisfactory quality for the purpose intended.
- B. The material related to the temporary silicone expansion joint system shall meet the applicable requirements of the CSI-formatted specification SECTION 07 95 10 – LONGITUDINAL JOINT SYSTEM.
- C. All material proposed for use that has been salvaged shall be subject to inspection by the Engineer. Material deemed to be damaged or otherwise unsuitable for use shall be removed from the site by the Contractor.
- D. Chemical anchoring material, if required, shall conform to CTDOT Form 816 Subarticle M.03.07.
- E. Proprietary products shall be used in accordance with the manufacturer's recommendations.

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS

- A. The Contractor shall fabricate and construct all work related to this item in general conformance with the plans and these specifications, and in a workman like manner.
- B. The work associated with installing the temporary silicone expansion joint system shall be performed in accordance with the applicable requirements of the CSI-formatted specification SECTION 07 95 10 – LONGITUDINAL JOINT SYSTEM.
- C. If drilling holes and grouting dowels is required, this work shall be done in accordance with the requirements of SECTION 03 21 15 - DRILLING HOLES AND GROUTING DOWELS AND ANCHOR BOLTS.
- D. Construction methods shall conform to the applicable requirements of CTDOT Form 816.
- E. All work shall be done in accordance with the NOTICE TO CONTRACTOR – WORK ON RAILROAD PROPERTY.

END OF SECTION 01 53 05

SECTION 01 53 10 - TEMPORARY SUPPORT SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work under this item shall consist of furnishing, installing, and removing a total of two (2) temporary support systems required to support existing stairways "A" and "F" during stage construction, as shown on the plans and as directed by the Engineer. The work shall be performed in accordance with these specifications.
- B. The information shown on the plans pertaining to temporary support systems conveys the assumptions made by the designer and is for information only. The Contractor shall be responsible for selecting the means and methods for construction.
- C. The Contractor shall also submit information in accordance with CTDOT Form 816 Article 1.05-02-3, and as noted below, and shall include design calculations, construction schematics, construction sequences and procedures to the Engineer for review.
- D. The Contractor is to take measures to minimize noise in all project areas, as required under CTDOT Form 816: Section 1.10 – Environmental Compliance and Article 1.10.05 – Noise Pollution.

1.2 SUBMITTALS

- A. **Working Drawings:** The Contractor shall, at least 30 calendar days prior to the start of construction of the temporary support systems, submit to the Engineer, for his review and approval, detailed final temporary support system working drawings and computations of his proposal, in accordance with the requirements of CTDOT Form 816 Article 1.5.02 and the NOTICE TO CONTRACTOR – SUBMITTALS.
 - 1. Codes and regulations of the jurisdictional authorities, including Metro-North, shall apply.
 - 2. The temporary support systems shall be designed to accommodate applicable load combinations in accordance with the latest *American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures* (ASCE7-10) and *AASHTO Standard Specifications for Highway Bridges*.
 - 3. The design of all temporary support system components shall be done using the service load method in accordance with the latest editions of the applicable *American Concrete Institute* (ACI) and *American Institute of Steel and Construction* (AISC) codes.
 - 4. In case of conflicts between referenced standards and these Specifications, the most stringent requirements, as determined by the Engineer, shall govern in each instance.

5. The Contractor shall make all field measurements necessary to completely detail the support systems and shall submit copies of all field measurements for review by the Engineer.
6. The working drawings and calculations must be prepared, stamped, and signed by a Professional Engineer licensed in the State of Connecticut.
7. The furnishing of such plans, methods and calculations shall not serve to relieve the Contractor of his responsibility for the safety of the work and the successful completion of the project. The Contractor's proposal must meet all requirements established in regulatory permits for the project and must also conform to the requirements of CTDOT Form 816 Section 1.10.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The materials for this work shall meet the requirements of CTDOT Form 816 Sections M.03 and M.06, as applicable, and shall be of satisfactory quality for the purpose intended.
- B. All material proposed for use that has been salvaged shall be subject to inspection by the Engineer. Material deemed to be damaged or otherwise unsuitable for use shall be removed from the site by the Contractor.
- C. Chemical anchoring material, if required, shall conform to CTDOT Form 816 Subarticle M.03.07.
- D. Proprietary products shall be used in accordance with the manufacturer's recommendations.

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS

- A. The Contractor shall fabricate and construct the temporary support systems in general conformance with the plans and these specifications, and in a workman like manner.
- B. The support system shall be installed prior to the partial demolition of the existing stairways "A" and "F", as applicable, and shall be installed with a tight fit to ensure the existing stairways do not deflect prior to transferring load to the support system. Details on the Contractor's proposed method for satisfying this requirement shall be included in the working drawing submission.
- C. If drilling holes and grouting dowels is required, this work shall be done in accordance with the requirements of SECTION 03 21 15 - DRILLING HOLES AND GROUTING DOWELS AND ANCHOR BOLTS.

- D. If attachments are made to existing concrete to remain in place, the attachments shall be removed and holes in the concrete shall be repaired in accordance with Specification SECTION 03 31 05 - VARIABLE DEPTH PATCH.
- E. Construction methods shall conform to the applicable requirements of CTDOT Form 816.
- F. All work shall be done in accordance with the NOTICE TO CONTRACTOR – WORK ON RAILROAD PROPERTY.

END OF SECTION 01 53 10

SECTION 01 56 23 - TEMPORARY BARRICADES AND GUARDRAIL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work under this item shall consist of furnishing, installing, and removing non-metallic temporary barricades and guardrail during construction, as shown on the plans and as directed by the Engineer. The work shall be performed in accordance with these specifications.
- B. The information shown on the plans pertaining to temporary barricades and guardrail conveys the assumptions made by the designer and is for information only. The Contractor shall be responsible for selecting the means and methods for construction.
- C. The Contractor shall also submit information in accordance with CTDOT Form 816 Article 1.05-02-3, and as noted below, and shall include design calculations, construction schematics, construction sequences and procedures to the Engineer for review.
- D. The Contractor is to take measures to minimize noise in all project areas, as required under CTDOT Form 816: Section 1.10 – Environmental Compliance and Article 1.10.05 – Noise Pollution.

1.1 SUBMITTALS

- A. **Working Drawings:** The Contractor shall, at least 30 calendar days prior to the start of construction of the temporary barricades, submit to the Engineer, for his review and approval, detailed final temporary barricade working drawings and computations of his proposal, in accordance with the requirements of CTDOT Form 816 Article 1.5.02 and the NOTICE TO CONTRACTOR – SUBMITTALS.
 - 1. Codes and regulations of the jurisdictional authorities, including Metro-North, shall apply.
 - 2. The temporary barricades and guardrail shall be designed to accommodate applicable load combinations in accordance with the latest *American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures* (ASCE7-10) and *AASHTO Standard Specifications for Highway Bridges*.
 - 3. The design of all temporary barricades and guardrail shall be done using the service load method in accordance with the latest editions of the applicable *American Concrete Institute* (ACI) and *American Institute of Steel and Construction* (AISC) codes.
 - 4. In case of conflicts between referenced standards and these Specifications, the most stringent requirements, as determined by the Engineer, shall govern in each instance.

5. The Contractor shall make all field measurements necessary to completely detail the temporary barricades and guardrail, and shall submit copies of all field measurements for review by the Engineer.
6. The working drawings and calculations must be prepared, stamped, and signed by a Professional Engineer licensed in the State of Connecticut.
7. The furnishing of such plans, methods and calculations shall not serve to relieve the Contractor of his responsibility for the safety of the work and the successful completion of the project. The Contractor's proposal must meet all requirements established in regulatory permits for the project and must also conform to the requirements of CTDOT Form 816 Section 1.10.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The materials for this work shall be **non-metallic** (except for fasteners and anchoring devices) and meet the requirements of the CTDOT Form 816, as applicable, and shall be of satisfactory quality for the purpose intended.
- B. All material proposed for use that has been salvaged shall be subject to inspection by the Engineer. Material deemed to be damaged or otherwise unsuitable for use shall be removed from the site by the Contractor.
- C. Chemical anchoring material, if required, shall conform to CTDOT Form 816 Subarticle M.03.07.
- D. Proprietary products shall be used in accordance with the manufacturer's recommendations.

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS

- A. The Contractor shall fabricate and construct the temporary barricades and guardrail in general conformance with the plans and these specifications in a workman like manner.
- B. The support system shall be installed in accordance with the construction staging plans.
- C. If drilling holes and grouting dowels is required, this work shall be done in accordance with the requirements of SECTION 03 21 15 - DRILLING HOLES AND GROUTING DOWELS AND ANCHOR BOLTS.
- D. If attachments are made to existing and proposed concrete to remain in place, the attachments shall be removed and holes in the concrete shall be repaired in accordance with Specification SECTION 03 31 05 - VARIABLE DEPTH PATCH. The barricades shall be tamper proof to prevent barriers from being vandalized.

- E. Construction methods shall conform to the applicable requirements of CTDOT Form 816.

END OF SECTION 01 56 23

SECTION 02 41 19 – REMOVAL OF EXISTING MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This work shall include the removal and satisfactory disposal of existing concrete (i.e. existing eastbound and westbound railroad double-tee platform sections, temporary double-tee platform section, full and partial removal of existing stairs, and existing ramps) at the locations and to the limits shown on the plans, the removal of which is necessary to the final completion of the work.
- B. This work shall also include the removal of the temporary silicone expansion joint system at the temporary platform.
- C. The Contractor is to take measures to minimize noise in all project areas, as required under CTDOT Form 816: Section 1.10 – Environmental Compliance and Article 1.10.05 – Noise Pollution.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. None

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS

- A. Existing masonry shall be removed to the lines shown on the plans or as ordered by the Engineer, due precaution being taken to avoid injury to new construction, public utility installations or abutting property. The material excavated shall be disposed of as directed by the Engineer.
- B. The concrete shall be removed to the limits shown on the plans. At locations where partial removal of concrete units is required, the Contractor shall perform the removal work using equipment and methods that minimizes damage to the concrete and reinforcing steel to remain in place unless such concrete is being abandoned in place.
- C. At locations where partial removal is required adjacent to concrete to remain, the Contractor shall saw cut the concrete to a minimum depth of one inch at the removal limits and shall use pneumatic hammers or any other method approved by the Engineer to remove the concrete. Maximum 31-pound hammers shall be used for general removal while maximum 15.5-pound

hammers shall be used near reinforcing steel that is to remain. Pneumatic tools shall not be placed in direct contact with the reinforcing steel that is to remain.

- D. Reinforcing steel shall be cut and removed as shown on the plans. Loose and small concrete fragments shall be cleaned from the reinforcing steel required to be left in place.
- E. The Contractor shall take necessary precautions to prevent any damage to the portions of the structure to remain. Any damage shall be repaired by the Contractor, as directed by the Engineer, and at no cost to the State.
- F. All debris shall be disposed of, from the site, by the Contractor.

END OF SECTION 02 41 19

SECTION 02 42 00 - REMOVAL AND SALVAGE OF CONSTRUCTION MATERIALS

PART 1 - GENERAL

1.1 SUMMARY

- A. Removal and demolition of selected items from selected areas of the station platform as indicated on the drawings, and as required to complete the work and the project objectives.

1.2 RELATED SECTIONS

- A. Section 12 93 40 – Site Furnishings

1.3 SELECTIVE DEMOLITION/SALVAGE

- A. Provide selective demolition, removals, and salvage in accordance with the Contract Documents. The Work of this Section includes, but is not limited to, the following: platform benches, platform recycling bins, station signage, existing metal guard rail and handrails with associated hardware and connections, bridge plates, existing lighting, as indicated on the drawings.
 - 1. Document with drawings and photographs keyed to drawings and label elements and materials designated for salvage.
 - 2. Provide temporary shoring as required to ensure stability of building elements and fabric to remain.
 - 3. Provide protection as required to protect both elements and materials to be removed and salvaged and elements and materials to remain from damage or deterioration.
 - 4. Remove and salvage all items as indicated on drawings and in technical provisions.
 - 5. Package and crate items to be salvaged, providing labels and tags.
 - 6. Deliver items to be restored and reinstalled to locations indicated or designated for restoration or storage.
 - 7. Deliver items to be salvaged but not reinstalled to locations designated by Owner.

1.4 DEFINITIONS

- A. **Remove:** Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. **Remove and Salvage:** Detach items from existing construction, in a manner to prevent damage,

and deliver to Owner ready for reuse.

- C. **Remove and Reinstall:** Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. **Existing to Remain:** Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- E. **Dismantle:** To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.5 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.6 SUBMITTALS

- A. **General:** Submit the following:
 - 1. Submit a schedule indicating proposed methods and sequence of operations for selective removal and demolition work prior to commencement of operations.
 - 2. Include details for dust and noise control operation. Provide a detailed sequence of removal and demolition work.
- B. **Selective Demolition/Salvage:**
 - 1. **Qualification Data:** Qualification data for firms and personnel that demonstrates that both firms and personnel have capabilities and experience complying with requirements specified for firm and foreman, provide a list of at least three completed projects within the Tri-State Area similar in size and scope to the work required on this project. For each project list project name, address, architect, scope of contractor's work, and other relevant information. This information shall be submitted with the bid.
 - 2. **Selective Demolition, Removal and Salvage Program:** Detailed description of methods and procedures, equipment, tools, and materials proposed for use in removal and salvage operations including, but not limited to, the following:
 - a. Documenting and identifying elements and materials to be removed.
 - b. Procedures for controlling noise and dust.

- c. Releasing or freeing materials and elements from existing construction.
 - d. Protection for elements to be removed and for elements to remain.
 - e. Handling and transporting materials and elements removed.
 - f. Packaging elements to be removed.
 - g. Storage locations.
 - h. Tools and methods of removing/salvaging items as indicated.
- 3. Documentation Photographs: Submit photographs electronically with a minimum resolution of 3 megapixels, recording condition of elements to be removed and salvaged (including overall views and close-up views of any cracks, damage, deterioration, or missing elements) before beginning selective demolition, removals, and salvage work.
 - 4. Shoring and Bracing: The Contractor shall retain the services of a Professional Engineer registered in the State of Connecticut to provide design of all temporary bracing, shoring, etc. that may be required as part of selective demolition, removals, and salvage work.
 - 5. It shall be the responsibility of the Contractor's Controlled Inspecting Agent to prepare detail drawings and associated calculations representing all shoring, bracing, or other temporary construction that may be required to maintain the structural stability and integrity of the existing construction during the course of the Work represented in these documents.
 - 6. All drawings and calculations prepared by the Contractor's Controlled Inspecting Agent shall bear an original signature and seal indicating the inspector's Connecticut State Registration. Duplicate copies of all drawings and calculations shall be forwarded to the Engineer prior to commencing any of the temporary work represented in those documents.

C. **Inventory:** Submit a list of items that have been removed and salvaged.

1.7 PERFORMANCE REQUIREMENTS

A. **Protections:** Provide temporary barricades and other forms of protection required to protect railroad personnel, and general public from injury due to selective removals and demolition work.

- 1. Provide protective measures as required to provide free and safe passage of personnel.
- 2. Protect from damage existing finish work that is to remain in place and which becomes exposed during operations.

B. **Damages:**

1. Promptly repair any and all damages to all property and finishes caused by the removals and demolition work, to the Engineer's satisfaction.

1.8 FIELD CONDITIONS

- A. **Hazardous Materials:** It is not expected that hazardous materials will be encountered in the Work.
 1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- B. Storage or sale of removed items or materials on-site is not permitted.

1.9 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. **Regulatory Requirements:** Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. **Standards:** Comply with ANSI/ASSE A10.6 and NFPA 241.

2.2 TOOLS

- A. **Hand Tools for Joint Preparation:** Chisels, hammers, and mallets.
 1. Thickness of Chisels: Chisels used in masonry joints shall have a maximum thickness of 5/8 times joint width extending back from tip of chisel at least two times depth at which chisel will be inserted into joint.
 2. Specials Tools: Provide special knives or special thin cutter blades for use in joints less than 1/8 in. in width.
- B. **Power Tools for Joint Preparation:** Small, hand-held electric grinders with diamond or abrasive blades no greater than 3/32 in. thick and a maximum of 4-1/2 in. diameter may be used to cut joints only under certain conditions as described in Part 3, below and if specifically approved by Engineer.
- C. **Brushes:** Stiff, natural bristle brushes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to commencement of the selective removals and demolition work, inspect the areas in which the work will be performed. Determine and list the existing conditions of rooms or area surfaces and equipment. After the Work in each respective area is completed, determine if adjacent surfaces or equipment have been damaged as a result of the Work; if so, the damage shall be corrected at the Contractor's expense.
- B. Verify that utilities have been disconnected and capped before starting selective demolition operations.

3.2 PREPARATION

- A. **Laws and Regulations:** All work shall comply with all safety requirements of the State of Connecticut and Town of Darien, Standard No. 241 "Safeguarding Building Construction and Demolition Operations," latest edition, of the National Fire Protection Association; and OSHA regulations.
- B. **General:**
 - 1. Protect against damage by water and fire, and injury to the public, workers, occupants, and contents of existing building, damage to adjacent property, and portions of platform not being selectively demolished. Contractor shall provide adequate protection to existing building, platform, utilities, and equipment, including temporary supports, dust and other enclosures, barricades, etc., as required to protect elements from damage or deterioration caused by work of this Section.
 - 2. Use every possible precaution to prevent damage to streets, sidewalks, curbs, retaining walls and paving on or adjacent to the site of the work. Repair or replace to Engineer's satisfaction and at no expense to Owner any such item destroyed or damaged.
 - 3. Protect all persons from injury and all public and private property and building contents from damage due to the operations under this Section. Adequate protection of persons and property shall be provided at all times, including Saturdays, Sundays, and holidays, during time period in which work is being performed, and after working hours.
 - 4. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 - 5. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 6. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden

space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.

7. Maintain fire watch after flame-cutting operations. Verify with MNR PM for requirements
8. Maintain adequate ventilation when using cutting torches.
9. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

- E. Existing Items to Remain:** Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.3 REMOVALS AND DEMOLITION WORK

- A.** Perform selective demolition work in a systematic manner and use such methods as required to complete the work indicated on the Drawings and as needed for completion of the work and the project objectives in accordance with the requirements of the Project Specification and governing City, State and Federal regulations.
1. Demolish and remove existing construction only to extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as specified herein.

2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Remove all electrical wiring, to include, but not limited to, lighting and all related appurtenances, conduits, devices, fixtures, and other electrical items accessories occurring on or in the construction to be removed, disconnect power and remove wiring and conduit back to source. New electrical work shall be as indicated on Drawings and as needed for the completion of the work and the project objective as specified in the Electrical – Div. 16.

3.4 FIELD QUALITY CONTROL

- A. Remove debris, rubbish and other materials resulting from the removals and demolitions from the building immediately; transport and legally dispose of materials off-site. Disposal method shall be in accordance with City, State, and Federal regulations.
- B. Burning of removed materials is not permitted on the job site.
- C. No materials shall be dropped or thrown from any height. Remove debris from building using suitable containers or conveyances.
- D. Keep premises clean by removing accumulation of waste materials, rubbish, and debris from site daily. Dispose of waste, rubbish, and debris in a proper manner in accordance with all federal, state and local laws and regulations, to the satisfaction of all authorities having jurisdiction, and to the satisfaction of the Engineer. Keep site and public rights of way clear. Take all precautions necessary to keep dust resulting from work of this Section at an absolute minimum.
- E. Do not store or permit excess debris to accumulate on site. If contractor fails to remove excess debris promptly, Engineer reserves the right to have debris removed at Contractor's expense.

3.5 TEMPORARY SHORING

- A. Provide temporary shoring as required to maintain existing construction safely in position during removal and salvage.
- B. Perform shoring in such a manner as to prevent any settlement or vertical or horizontal deformation of the existing building elements to remain. Before commencing with the work, the Contractor shall thoroughly investigate the existing structure to verify its present condition.
- C. Execute shoring in best, substantial, workmanlike manner to avoid danger to workman and public and damage to the building.

3.6 CLEAN-UP AND REPAIR

- A. Upon completion of removals and demolition Work, remove tools, equipment and all remaining demolished materials from the site.
- B. Repair all damaged areas caused by the removals and demolition Work. Repair adjacent construction or surfaces soiled or damaged by selective demolition work at contractor's expense to the Engineer's approval.
- C. All areas in which Work was performed under this Section shall be left "broomclean."

END OF SECTION 02 42 00

SECTION 03 21 15 - DRILLING HOLES AND GROUTING DOWELS AND ANCHOR BOLTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work under this item shall consist of drilling or coring holes in concrete and grouting (by means of chemical anchoring) reinforcing steel dowels and anchor bolts at the locations shown on the plans, in accordance with the plans, the manufacturer's recommendations, and as directed by the Engineer.
- B. The Contractor is to take measures to minimize noise in all project areas, as required under CTDOT Form 816: Section 1.10 – Environmental Compliance and Article 1.10.05 – Noise Pollution.
- C. Reinforcing steel bars shall conform to the details shown on the plans and the applicable sections of the CSI-formatted specification SECTION 03 30 00 - CAST-IN-PLACE CONCRETE.
- A. Anchor bolts shall conform to the details shown on the plans and the CSI-formatted specification SECTION 03 41 05 – PLATFORM SECTION.

1.2 SUBMITTALS

- A. Before fabricating any materials, the Contractor shall submit manufacturer's specifications and installation requirements for the chemical anchoring material to the Engineer for review in accordance with CTDOT Form 816 Article 1.05.02.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Chemical anchoring material shall conform to CTDOT Form 816 Subarticle M.03.07.

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS

- A. Holes for the reinforcing steel dowels and anchor bolts shall be drilled or cored, and shall be located as shown on the plans. The holes shall clear the existing reinforcement and provide the minimum cover as shown on the plans. A pachometer shall be used to locate existing reinforcing steel. If existing reinforcing is encountered during the drilling operation, the holes

shall be relocated and the uncompleted holes shall be filled with the chemical anchoring material and finished smooth and flush with the adjacent surface.

- B. The depth and diameter of each hole shall be as shown on the plans. If the diameter of a hole is not shown, the diameter of the hole shall conform to the manufacturer's recommendations for the diameter of the dowel being anchored. If the depth and diameter of a hole are not shown, the hole shall conform to the manufacturer's recommendations for the diameter of the dowel being anchored such that the grouted dowels will be able to develop, in tension, 100 percent of its specified yield strength.
- C. Hole drilling methods shall not cause spalling, cracking, or other damage to the existing concrete. The weight of the drill shall not exceed 13 lbs. Those areas damaged by the Contractor shall be repaired by him in a manner suitable to the Engineer and at no expense to the State.
- D. Prior to placing the chemical anchoring material in the holes, the holes shall be cleaned of all dirt, moisture, concrete dust and other foreign material. The dowel/anchor bolt and the chemical anchoring material shall be installed in the holes in accordance with the chemical anchoring material manufacturer's recommendations.
- E. The Contractor, as directed by the Engineer, shall take adequate precautions to prevent any materials from dropping to the area below, which may result in damage to any existing construction or to adjoining property. Should any damage occur to the structure as a result of the Contractor's operations, the Contractor shall make repairs at his own expense. The repair work shall be approved in advance and shall be of a quality acceptable to the Engineer.

END OF SECTION 03 21 15

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Contractor shall coordinate work with that of other trades affecting or affected by the work included under this Section and shall cooperate with such trades, the Engineer, the Designer and the Department to assure the steady and timely progress of the work.

1.2 DESCRIPTION

- A. Provide all materials and labor necessary to complete all concrete, plain and reinforced as indicated on the Plans or called out for in these specifications within the limits of "Rail Facility Upgrade (Site No. 1)" and as required to complete the Project. Work includes, but is not limited to, the following:
 - 1. The installation of cast-in-place concrete stairs and other elements indicated on the plans.
 - 2. All forms, staging, bracing and other materials and equipment necessary and required to produce the concrete in place and for removal of same.
 - 3. Installation of reinforcing steel, including accessories and supports.
 - 4. Finishing of concrete as specified herein or as indicated on the plans.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Carefully examine all of the Contract Documents for requirements which affect the work of this section.
 - 1. Carefully review all of the Contract Documents for anchor bolts, inserts, conduits, sleeves, anchors, and all other items which must be cast into concrete construction, if required.
 - 2. Items to be embedded in concrete work may or may not be described in detail and must be determined through careful coordination of all subcontractors and building trades.
- B. Other specifications sections that directly relate to the work of this section include, but are not limited to, the following:
 - 1. Section 07 92 00 – Joint Sealants and Caulking

1.4 SUBMITTALS

- A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and the NOTICE TO CONTRACTOR - SUBMITTALS.

- B. **Shop Drawings:** Submit shop drawings and schedules of all work under this Section for approval prior to fabrication of any material. Shop drawings shall include sufficient plans, sections and detail drawings to suitable scale to permit the erection of the reinforcing steel. Reinforcement: Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures". Shop Drawings shall include but not be limited to the following:
1. Bar reinforcement shop drawings shall include setting plans, elevations, bending diagrams, cutting lists and other information so as to define and establish completely the location, spacing, size, length, bending, shape, splicing and keying at construction joints and all other pertinent information as required. Drawings shall show grades of reinforcing steel. Opposite hand reinforcing shall be detailed separately.
 2. Type, size and location of all accessories required for proper assembling, placing and support of the reinforcement.
 3. All openings, depressions, construction joints, control joints, trenches, sleeves, inserts, and all other project requirements affecting reinforcing details and placing.
 4. Sizes, thickness of material, methods of assembly, anchorage, galvanizing, shop paint and all other information necessary.
- C. **Field and Laboratory Testing; Certified Test Reports:** Field and laboratory testing shall be performed, and certified test reports provided, in accordance with the applicable requirements of CTDOT Form 816 "Section 6.01 Concrete for Structures" and "Section M.03 Portland Cement Concrete".
- D. **Materials Certificates:** Provide materials certificates in accordance with the applicable requirements of CTDOT Form 816 "Section M.03 Portland Cement Concrete".

1.7 PRE-INSTALLATION MEETING

- A. Conduct a Pre-Installation Meeting at the Project Site in compliance with the requirements of CTDOT Form 816 Subarticle 1.20-1.05.24-2.
- B. Prior to submittal of the specified concrete design mixes, the Contractor shall schedule a meeting to review procedures for producing proper concrete construction.
- C. The Contractor shall require attendance by responsible representatives of every party who is involved with the concrete work including, but not limited to, the following:
 1. Contractor's superintendent.
 2. Testing Agency responsible for the concrete mix design.
 3. Testing Agency responsible for field quality control.
 4. Concrete Sub-contractor.
 5. Ready-mix concrete producer(s).

6. Admixture manufacturer.
 7. Concrete pumping Contractor.
 8. Formwork Contractor.
 9. Concrete Finisher.
- D. The Designer will be present at the meeting and must be notified at least 10 days prior to the scheduled date of the meeting.
 - E. Minutes of the meeting shall be recorded, published and distributed by the Contractor to all parties concerned within 5 working days of the meeting.

PART 2 - PRODUCTS

2.1 REINFORCING MATERIALS

- A. Epoxy-Coated Reinforcing Bars: ASTM A 615, grade 60 epoxy coated in accordance with ASTM D 3963.
- B. Epoxy-Coated Wire and Welded Wire Fabric: ASTM A 884 with $F_y = 70\text{ksi}$.
- C. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI specifications. Wire for tying shall be 18 gauge black annealed wire conforming to ASTM A 82.
 1. For structural slabs, use supports with sand plates or horizontal runners where base material will not support chair legs.
 2. For concrete surfaces exposed to view, where legs of supports are in contact with forms, provide supports with legs that are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).
- D. Fabrication: Reinforcement shall be accurately formed to dimensions of the plans, details and schedules. Fabrication shall not commence until details and schedules have been approved by the Designer in writing.
 1. Reinforcement shall be bent cold, around a pin with a free revolving collar having a diameter ratio to the diameter of the bar not less than:
 - Two times for stirrups
 - Six times for bars up to and including 1 inch
 - Eight times for bars over 1 inch
 2. Reinforcement shall not be straightened or re-bent in a manner that will injure the material. Bars with kinks or bends not shown on the plans will not be used.

2.2 CONCRETE AND RELATED MATERIALS

The materials for this work, including aggregates, cement, water, admixtures; mix design requirements; producer equipment and production requirements; curing materials; non shrink, non-staining grout; chemical anchors; joint materials; protective compound/sealers; and formwork shall conform to the requirements of CTDOT Form 816 "Section M.03 Portland Cement Concrete". The grades of concrete shall be as shown on the contract plans.

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS:

- A. The construction methods used for this work, including false work and forms; protection from environmental conditions; transportation and delivery of concrete; acceptance testing and test specimens; progression cylinders and compressive strength specimens; handling and placing concrete; bearing surfaces; curing concrete; finishing concrete surfaces; mortar, grout, epoxy and joint seal; application of loads; and dispute resolution shall conform to the applicable requirements of CTDOT Form 816 "Section 6.01 Concrete for Structures".

END OF SECTION 03 30 00

SECTION 03 31 05 - VARIABLE DEPTH PATCH

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work under this item shall consist of removing loose, deteriorated concrete and concrete overlaying hollow areas and applying a cementitious mortar to these areas as well as spalled and scaled areas as shown on the plans, as directed by the Department, and in accordance with these specifications.

1.2 SUBMITTALS

- A. **Certification:** A Materials Certificate and Certificate of Compliance shall be required for the Cementitious mortar and the zinc primer in accordance with Article 1.06.07, certifying the conformance of this material to the requirements stated herein.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The cementitious mortar shall be one of the following:
 - 1. 5 Star Structural Concrete V/O
Manufactured by:
Dayton Superior Corp.
401 Stillson Road
Fairfield, CT 06430
 - 2. Re-crete 20 Minutes Set
Manufactured by:
Dayton Superior Corp.
3 Horne Drive
Folcroft, PA 19032
 - 3. Masterpatch 230 VP
Manufactured by:
Master Builders, Inc.
23700 Chagrin Boulevard
Cleveland, OH 44122
- B. The single component zinc primer shall be one of the following:

1. Kolor-Zinc No. 0100
Manufactured by:
Keeler & Long, Inc.
856 Echo Lake Road
Watertown, CT 06795
2. Zinc Plate 49 Organic Primer Type 2
Manufactured by:
Con-Lux Coatings, Inc.
Talmadge Road, Box 847
Edison, NJ 08818
3. Carboline 676
Manufactured by:
Carboline
350 Hanley Industrial Court
St. Louis, MO 63144

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS

- A. Before any concrete is removed, the Department shall perform an inspection to determine the exact limits and locations of all areas to be repaired.
- B. The perimeter of each deteriorated area shall be squared up to a minimum of ½-inch deep by chiseling or sawcutting.
- C. In areas where reinforcing steel is found to be surrounded by deteriorated concrete or has at least one-half its surface area exposed or has less than 1" cover, the depth of removal shall be such as to include all deteriorated concrete but not less than ¾" around the reinforcing steel.
- D. Loose and deteriorated concrete and hollow areas shall be chipped away back to sound concrete. The exposed concrete surfaces shall be thoroughly sandblasted and vacuumed immediately prior to applying the mortar.
- E. Hollow areas in the existing concrete shall be completely exposed by chipping away back to sound concrete and thoroughly sandblasted and vacuumed immediately prior to applying the mortar.
- F. Care shall be taken not to cut existing reinforcing.
- G. Spalled and scaled areas shall be cleaned of all loose and deteriorated concrete. The exposed surfaces shall be thoroughly sandblasted and vacuumed immediately prior to applying mortar.
- H. All surfaces of exposed concrete and reinforcing steel shall be free of oil, solvent, grease, dirt, dust, bitumen, rust, loose particles, and foreign matter. Prior to sandblasting of the concrete and

steel surfaces, all petroleum contamination on these surfaces shall be removed by an appropriate solvent or detergent cleaning operation.

- I. All compressed air equipment used in cleaning shall have properly sized and designed, attached and functional, oil separators to assure the delivery of oil-free air at the nozzle.
- J. Extreme care shall be taken, where reinforcing steel is uncovered, not to damage the steel or its bond in the surrounding concrete. At substructure locations, pneumatic tools shall not be placed in direct contact with reinforcing steel. Maximum 30# size hammers shall be used for general chipping and removal while maximum 15# size shall be used behind reinforcing steel. Exposed reinforcing steel shall be sandblasted in accordance with SSPC-SP-6, Commercial Blast Cleaning, to remove all contaminants, rust and rust scale.
- K. The exposed blast cleaned reinforcing steel shall be coated with the single component zinc primer brush. All application of the zinc primer shall be in accordance with the manufacturer's printed instructions.
- L. If the existing reinforcing steel is severely corroded or damaged, the Department shall be notified immediately.
- M. Adequate measures shall be taken by the Contractor to prevent concrete chips, tools and/or materials from migrating into adjacent track and pedestrian areas. When using sandblasting equipment, all work shall be shielded to prevent debris from migrating into adjacent track and pedestrian areas. Debris from sandblasting shall be collected, removed, and satisfactorily disposed of by the Contractor from the site.
- N. All mixing and application of the mortar shall be done in strict accordance with the printed instructions supplied by the manufacturer and as directed by the Department.
- O. At the same time of mortar application, the concrete surfaces against which this material is to be placed shall be sound, tight, and thoroughly roughened by the removal and sandblasting procedures specified above. The exposed concrete surfaces shall be dampened with fresh water (saturated surface dry) immediately prior to placement of the mortar. The minimum ambient and patch area surface temperatures shall be 45oF and rising at the time of mortar application.
- P. The mortar shall be packed into the substrate, filling all pores and voids, then forced against the edges of the repair, working toward the center. After filling the voids, the mortar shall be compacted and the surfaces finished with a trowel to match the original contours of the existing concrete or to the specified build-out as detailed on the plans.
- Q. A fine spray mist of water shall be used to aid the cure of the patches by preventing the surface from drying for a minimum of 2 hours.
- R. Cured patches shall be sounded by the Department to detect the presence of any hollow areas. Such areas shall be removed and replaced by the Contractor at his own expense until an acceptable patch is in place.

END OF SECTION 03 31 05

SECTION 03 31 10 - EPOXY INJECTION CRACK REPAIR

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This item shall consist of re-bonding cracked concrete structures with a two component modified epoxy resin system injected in to the crack under low pressure using continuous positive displacement metering and mixing equipment, as shown on the plans or as directed in accordance with these specifications.
- B. The Contractor shall not perform any repair work without prior approval by the Department for locations, limits, and type of repairs.

1.2 SUBMITTALS

- A. **Certification:** A Material Certificate and a Certificate of Compliance in accordance with Article 1.06.07 shall accompany each batch or lot of the material delivered to the job site to verify the epoxy resin's conformance with the manufacturer supplied infrared spectroscopy test results. *NOTE: A batch of each component will be defined as that of material which has been subjected to the same unit chemical or physical mixing process intended to make the final product substantially uniform.*
 - 1. A sample of liquid epoxy resin Components A and B shall be taken and shall consist of one pint per batch of each component represented in each shipment.
 - 2. The samples shall be presented to the Laboratory a minimum of 14 calendar days before incorporation of any of the batch into the work.
 - 3. The Laboratory shall conduct the Infrared Spectroscopy Test on the samples (see attached Appendix A).
 - 4. Each test results shall be compared to the "Pre-qualification Procedures" test results on file with the Laboratory.
 - 5. Two materials are considered to be identical if all of the absorption points agree as to wave length and relative magnitude of the peaks in comparison with the other points of absorptions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The epoxy resin shall be a pre-qualified material (see attached Appendix A).

- B. Each component shall be packaged in steel containers not larger than 5 gallons in volume. The containers shall have lug type crimp lids with ring seals, shall be new, shall not be less than 0.024-inch nominal thickness, and shall be well sealed to prevent leakage. If a lining is used in the containers, it shall be of such character as to resist any action by the components. Each container shall be clearly labeled with the description (component A or B), the manufacturer's name, date of manufacture, batch number, and the following warning:
 - 1. **CAUTION:** *This material will cause severe dermatitis if it is allowed to come in contact with the skin or eyes. Use gloves and protective creams on the hands. Should this material contact skin, wash thoroughly with soap and water. Do not attempt to remove this material from skin with solvents. If any gets in the eyes, flush for 10 minutes with water and secure immediate medical attention.*
- C. Any material which shows evidence of crystallization or a permanent increase in viscosity or settling of pigments which cannot be readily re-dispersed with a paddle shall not be used.

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS

- A. A survey shall be undertaken by the Department on the areas designated on the plans to determine the exact limits and location of the repair areas under this item. Cracks less than 1/8" in width need not be repaired under this item.
- B. At the time of mixing, Components A and B and the substrate temperature shall be between 50°F and 85°F, unless the material has been prequalified at a temperature less than 77°F, in which case this lesser temperature shall govern the use of the material. Any heating of the adhesive components shall be done by application of the indirect heat. Immediately prior to filling the tanks of the mixing equipment, each component shall be thoroughly stirred with a paddle. Separate paddles shall be used to stir each component.
- C. Prior to sealing, the crack shall be cleaned free of dust, silt and any other material which would impair bonding. Cleaning shall be done with oil-free compressed air jets or preferably by vacuum cleaning with an industrial vacuum cleaner.
- D. Injection ports shall be inserted in the cracks at intervals recommended by the epoxy manufacturer. The Contractor may use either surface or insertable injection ports, whichever is recommended by the epoxy manufacturer. Spacing of the ports shall be such that the injected adhesive will substantially fill the crack without excessive waste. The spacing of the ports shall be adjusted as the injection process progresses in order to meet this requirement.
- E. Drilling of the injection ports shall be done with a hollow drill bit to which vacuum is applied with an industrial vacuum cleaner. The Contractor shall avoid reinforcing steel during drilling operations. A pachometer may be used to locate and avoid reinforcing steel.
- F. The surface of the crack between ports shall be sealed with tape and/or temporary surface sealant which is capable of retaining the epoxy adhesive in the crack during pressure injection and shall remain in place until the epoxy adhesive has hardened. Sealant tape and/or other

temporary surface sealant shall be removed when no longer required and any spillage of epoxy shall be removed. No cleanup of surfaces not generally viewed by the public will be required unless the surface sealant will interfere with subsequent surface treatments.

- G. Epoxy adhesive shall be pumped into the cracks through the injection ports. The pump, hose, injections gun and appurtenances shall properly proportion and mix the epoxy and shall be capable of injecting the epoxy at a sufficient rate and pressure to completely fill all designated cracks. A suitable gasket shall be used on the head of the injection gun to prevent the adhesive from running down the face of the concrete. Pumping pressure shall be kept as low as practicable.
- H. The temperature of the concrete shall not be less than 50°F at the time epoxy is injected, unless the epoxy has been prequalified at a lower temperature as hereinbefore provided, in which case the lower temperature shall govern.
- I. For a crack with a uniform thickness, the epoxy adhesive shall be forced into the first port at one end of the crack until adhesive runs in substantial quantity from the next adjacent port. The first port shall then be sealed and injection shall commence at the next port. Injection shall then continue from port to port in this manner until the crack is fully injected.
- J. Cracks with varying thickness shall have the epoxy adhesive forced into the port at the widest gap in the crack until adhesive runs in substantial quantity from the two adjacent ports. The first port shall then be sealed and injection shall commence at the adjacent port corresponding to the shorter side of the crack. Injection shall then continue from port to port in this manner until the shorter side of the crack is fully injected. Similarly, injection shall continue from port to port on the longer side of the crack, beginning with the port that was filled with epoxy adhesive but not sealed, until the crack is fully injected.
- K. For slanting or vertical cracks, pumping shall start at the lower end of the crack. Where approximately vertical and horizontal cracks intersect, the vertical crack below the intersection shall be injected first. The ports shall be sealed by removing the fitting, filling the void with epoxy and covering with tape or surface sealant.
- L. Before starting injection work and at 2-hour intervals during injection work, whenever requested by the Department, a 3 fluid-ounce sample of mixed epoxy shall be taken from the injection gun. Should these samples show any evidence of improper proportioning or mixing, injection work shall be suspended until the equipment or procedure are corrected.
- M. Samples obtained above shall be used directly, without further stirring, to make test pieces for the Slant Shear Strength on Dry Concrete. One test piece shall be made at the beginning, the middle, and the end of daily operations. The samples shall be allowed to cure for 7 days in the "Concrete Cylinder Curing Box". On the 7th day, the samples shall be removed to the Laboratory and tested in accordance with the requirement for the Slant Shear Strength (see attached Appendix A).
- N. Each sample shall be numbered consecutively and dated (with a waterproof marker) and shall note which sample represents which part of the structure.
- O. Technical Advisor: The Contractor shall provide the Department with a notarized statement showing a specific record of epoxy injections actually made by the Contractor and/or a specific

record of training of his employees in epoxy injection repairs taught by the epoxy manufacturer. If the statement is not produced or is deemed insufficient by the Department, the contractor shall obtain the services of a Technical Advisor who is employed by the epoxy manufacturer. The Technical Advisor shall assist the Department and the Contractor in the correct use of the injection resin. The Advisor shall be a qualified representative, approved by the Department, and shall be at the site of the work when the work begins in connections with the epoxy injection, and at such other times as the Department may request until completion of work under this item.

NOTE: APPENDIX A BEGINS ON NEXT PAGE.

APPENDIX A

Prequalification Procedure

The Prequalification Procedure shall consist of the following test procedures on the mixed epoxy resin at a temperature of 77°F, unless the Contractor desires to use the material at a lower temperature than 50°F, in which case the lower temperature shall be used to condition the material and test pieces.

Test: Viscosity

Requirement: 900 centipoise, maximum at 77°F (62°F)
4000 centipoise, maximum at any test temperature
Test Method: ASTM D2393

Test: Gel Time (Pot Life)

Requirement: 4 to 60 minutes
Test Method:

A. Apparatus:

1. Unwaxed paper cups, 8 oz, 2 inches 4 1/4" at base.
2. Wooden tongue depressor with ends cut square.
3. Stainless steel spatula with 6"x1" blade and with end cut square.
4. Stopwatch, 1 second or smaller divisions.
5. Balance, 0.1 gram divisions.

B. Test Procedure:

1. Condition both Components A and B to required temperature (62°F).
2. Measure proper volumes of well mixed Components A and B into an 8-oz. unwaxed cup to yield total mass of 60 (62.0) grams.
3. Start stopwatch immediately and mix components for 60 seconds, stirring with a wooden tongue depressor, taking care to scrape the sides and bottom of the cup periodically.
4. Place the sample at the required temperature (62°F) on a wooden bench top which is free of excessive drafts.
5. Probe the mixture with the tongue depressor once every 30 seconds starting 4 minutes from the time of mixing.
6. The time at which a soft stringy mass forms in the cup is the gel time.

Test: Slant Shear Strength on Wet Concrete

Requirement: 1700 psi, minimum after 7 days of cure in air at the required temperature (62°F).

Test: Slant Shear Strength on Dry Concrete

Requirement: 4500 psi, minimum after 7 days of cure in air at the required temperature (62°F).

Test: Slant Shear Strength

A. Materials

1. Ottawa sand, ASTM C109
2. Portland cement Type II
3. Water

B. Apparatus:

1. Suitable mold to make diagonal concrete mortar block with a square base of 2-inch sides, and having one 2"x4" diagonal face, starting about 3/4" above the base. The diagonal faces of two such blocks are bonded together producing a block of 2"x2"x5" dimensions.
2. Blocks are made from the following composition:
 - Ottawa sand, ASTM C109 30.1 lbs.
 - Portland Cement Type II 12.1 lbs.
 - Water 4.8 lbs.
 Cure blocks 28 days in a fog room. Dry and lightly sandblast diagonal faces.
3. Suitable test press.

C. Test Procedure:

1. Condition the components for 4 hours at the required temperature (2°F). Without entrapping air, stir the separate components for 30 seconds and place the proper volumes of each component on a plate and mix with a spatula for 60 seconds. Apply a coat approximately 0.010-inch thick to each diagonal surface. Place four 1/8" square pieces of shim stock 0.012" thick on one block to control final film thickness.
2. Before pressing the coated surface together, leave the blocks so that the coated surfaces are horizontal until the epoxy reacts slightly to prevent excessive flow. Press diagonal surfaces of each block together by hands and remove excess epoxy adhesive.
3. Align the blocks so that the ends and sides are square and form a 2"x2"x5" block. Use blocks of wood or metal against each 2"x2" end to keep the diagonal faces from slipping until epoxy hardens.
4. After the required cure time, apply a suitable capping compound to each of the 2"x2" suitable testing apparatus at the rate of 5000 lbs./min until failure.

Report results in pounds per square inch = $\frac{1}{4} \times (\text{Load in Pounds})$

5. For wet shear strength, soak another set of block in water for 24 hours at the require temperature (62°F). Remove and wipe off excessive water. Prepare, cure and test sample according to above test procedure.

Test: Tensile Strength

Requirement: 4500 psi, minimum

Test: Elongation

Requirement: 15% maximum

Test Method: Tensile Strength and Elongation

A. Apparatus:

1. Leveling table about 12"x8" with removable rim 1/4" thick by 1/2" wide.
2. Mylar or similar plastic sheeting 0.004" thick.
3. Air circulation oven capable of maintaining 158°F (63°F).
4. Cutting die, Figure 1.
5. Thickness gauge, 1/8".
6. Release agent, non-silicone type.

B. Procedure:

1. Place mylar sheet on leveling table.
2. Coat inside edge and bottom of rim with release agent and secure table with screws.
3. Level the table.
4. Mix sufficient volume of well-mixed Component A and well-mixed Component B in the proper volumes so as to be able to form a layer 1/8" deep when placed inside of the ring on the leveling table.
5. Introduce as few bubbles as possible during mixing.
6. Flush surface of epoxy with a heat gun or Bunsen burner to remove air bubbles on surface. Repeat if necessary.
7. Allow the specimen to cure for 18 hours at the required temperature (62°F).
8. Remove specimen from table and strip off mylar sheet. Cure specimen at 158°F (63°F) for 5 hours
9. Allow specimen to cool to the required temperature and cut specimens using using cutting die shown on Figure 1.
10. Proceed as specified in ASTM d638 using 0.2 inch/minute test rating, and 1" gauge length.

Test: Infrared Curve

Requirement: Infrared Curve shall be obtained of Components A and B

Test method: Recording Spectrophotometer

A. Apparatus:

1. Perkin-Elmer Model 137-B Infracord Spectrophotometer, automatic recording system from 2.5 to 15 microns, with a two-speed recorder. Comparable results can be obtained by other double-beam recording spectrophotometers with similar resolution.
2. Disk holder for a 1"-diameter disk.
3. Two sodium chloride crystal disks, one inch in diameter.
4. Sorvall SS-3 Automatic Superspeed Centrifuge, or a comparable centrifuge, which is able to separate the liquid and solid phases of the epoxy components without previous dilution with solvents.

B. Procedure:

1. Place about 15 grams of Component A into a stainless centrifuge tube.
2. Counterbalance with Component B in a second centrifuge tube.
3. Centrifuge the two components at 17,000rpm until there is a supernatant liquid layer present in each tube. This takes 20 – 30 minutes.
4. Place a drop of Component A liquid layer on a sodium chloride disk.
5. Place another sodium chloride disk over the drop, rotate and press down until the liquid has flowed into a uniform layer of proper thickness between the two sodium chloride disks.
6. Place the disk in the holder and run an absorption curve with the infrared spectrophotometer.
7. More or less liquid may be used between the disks so as to produce a maximum absorption of 0.7 to 1.0 for the strongest absorption point on the above.
8. Clean disks with toluene and dry.
9. Repeat steps 4 through 8 with the liquid layer from Component B.
10. Record each curve in order that they may be used for comparison purposed to lots of material delivered to the job site.

END OF SECTION 03 31 10

SECTION 03 41 01 – PRECAST STRUCTURAL CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work specified in this section consists of the furnishing and installation of the precast structural concrete elements indicated on the plans, including platform stairs/landings, and platform ramps.

1.4 SUBMITTALS

- A. Shop Drawings
 - a. The Contractor shall submit shop drawings in accordance with the requirements of CTDOT Form 816 Section 1.05.02, the NOTICE TO CONTRACTOR – SUBMITTALS, and the following.
- B. Manufacturer's Product Data
- C. Working Drawings
 - 1. Working drawings shall be submitted for installation of precast elements. Drawings shall include crane size and location, lifting points and devices, sequence of installation and any other pertinent information. All calculations and drawings shall be stamped by a Professional Engineer registered in the State of Connecticut.
- D. Design Calculations
 - 1. All precast elements which require calculations shall have calculations submitted which have been stamped by a Professional Engineer registered in the State of Connecticut.

1.5 TESTING

- A. The Contractor is responsible for all testing to ensure all components are in conformance with the specifications.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Precast Concrete:
 - 1. Conforming to CTDOT Form 816 Sections 8.21.02, 8.21.03-1, and 8.21.03-5.

B. Reinforcing steel:

1. Reinforcing steel shall conform to the requirements of CTDOT Form 816 Section M.06.01.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prior to fabrication of any elements the Contractor shall furnish shop drawings for all elements included in this specification including precast elements, reinforcement, and associated hardware. Drawings shall include all dimensions of the finished pieces including reinforcement bending diagrams.
- B. Marking: Each completed precast member shall be identified with the name of the manufacturer, CTDOT project number, structure number, casting date, and piece number. Markings shall be made by either casting directly into the member or by suitable stenciling. Marks shall be located such that they are not visible after installation.

3.2 INSTALLATION

- A. Structural precast elements shall be installed at the locations shown on the plans. Elements to be placed on earth shall have all soil surfaces compacted prior to placement of the precast elements. Elements to be placed in contact with existing stone or masonry surfaces shall have the contact surface leveled with a bed of mortar prior to placement of the precast concrete. The mortar shall be wet when the precast is placed and the precast firmly seated with full contact. Backfill (if required) shall not be placed until the mortar has cured and, if called for, dowels drilled and anchored.

END OF SECTION 03 41 01

SECTION 03 41 05 – PLATFORM SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work shall consist of furnishing, fabricating, transporting, storing, handling, and erecting all the elements that make up the platform sections, at the locations indicated on the Plans. This work includes all necessary materials and equipment to complete the work as shown on the plans, including all galvanized structural steel (girders, diaphragms, connection plates, bearing plates, load plates, keeper angles, embedded angles, edge plates, anchor rods at the fixed bearings of the piers, hold down clamps, high strength bolts for the hold down clamps), precast platform panels, epoxy-coated reinforcing steel, HSS (Hollow Structural Sections) and non-shrink grout for platform panel joint connections, galvanized threaded inserts at the hold down clamps, stainless steel inserts and anchor rods for the polyethylene rub rail, and premolded pads.
- B. The cast-in-place microsilica concrete to be placed as an overlay to the precast platform panels shall be furnished and installed in accordance with the details shown on the plans and the CSI-formatted specification SECTION 03 53 20 – MICROSILICA CONCRETE OVERLAY.
- C. The waterproofing system to be applied to the microsilica concrete overlay of the platform sections shall be a spray-applied, fast cure, high-build polymer system with a broadcast aggregate. It shall conform to the requirements shown on the plans and the CSI-formatted specification SECTION 09 67 10 – RAILROAD PLATFORM WATERPROOFING.
- D. The tactile warning surfacing to be applied to the platform section microsilica concrete overlay shall be furnished and applied in accordance with the details shown on the plans and the CSI-formatted specification SECTION 09 61 40 - DETECTABLE / TACTILE WARNING SURFACES.
- E. Joints for the platform sections shall be furnished and constructed in accordance with the details shown on the plans and the CSI-formatted specifications SECTION 07 91 15 – PLATFORM EXPANSION JOINT SYSTEM, SECTION 07 92 05 - CONCRETE OVERLAY JOINT, SECTION 07 92 10 – FIXED PLATFORM JOINT, and SECTION 07 95 10 – LONGITUDINAL JOINT SYSTEM.
- F. Polyethylene rub rail units to be installed on the track sides of the platform sections shall be furnished and installed in accordance with the details shown on the plans and the CSI-formatted specification SECTION 06 64 00 – POLYETHYLENE RUB RAIL.
- G. Steel laminated elastomeric bearing pads for the platform sections shall be furnished installed in accordance with the details shown on the plans and the CSI-formatted specification SECTION 34 82 10 – STEEL LAMINATED ELASTOMERIC BEARINGS.

1.2 SUBMITTALS

- A. **Working Drawings:** The Contractor shall submit working drawings addressing all the elements that make up the platform sections, in accordance with the requirements of CTDOT Form 816 Sections 6.03.03-3 and 1.05.02, and the NOTICE TO CONTRACTOR – SUBMITTALS, and the following.

1. At a minimum, the Working Drawings shall include the following information:
 - a. Fabrication/Assembly Plan:
 - 1) Working drawings shall be stamped by a Professional Engineer licensed in the State of Connecticut.
 - 2) Tolerances and procedures for controlling tolerance limits both horizontally and vertically during assembly operations.
 - 3) Handling and transporting the structural steel and precast platform panels.
 - 4) Erection plans for the structural steel elements and precast platform panels, including lifting inserts, hardware, or devices and locations on the working drawings for Engineer's approval, including supporting calculations, type, and amount of any additional reinforcing required for lifting the precast platform panels.

- B. **Shop Drawings:** The Contractor shall submit shop drawings addressing all the elements that make up the platform sections, in accordance with the pertinent requirements of CTDOT Form 816 Sections 5.14.03-1 and 6.03.03-2, and the NOTICE TO CONTRACTOR – SUBMITTALS, and the following.

1. At a minimum, the Shop Drawings shall include the following information:
 - a. Structural steel details, size, type and grade, in accordance with CTDOT Form 816 Section 6.03.03, including a cambering procedure and recalculated diagrams if required.
 - b. Reinforcement details in accordance with CTDOT Form 816 Section 6.02.03-1.
 - c. Locations of all inserts.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. **Structural Steel:** All structural steel shall be galvanized and of the type and grade designated on the plans and shall conform to the pertinent requirements of CTDOT Form 816 Section M.06.02.
- B. **Anchor Rods (at the fixed bearings of the piers) and High Strength Bolts (for the hold down clamps):** The anchor rods (at the fixed bearings of the piers), high strength bolts (for the hold down clamps), and washers shall be galvanized and of the type and size designated on the plans and shall conform to the pertinent requirements of CTDOT Form 816 Sections M.06.02-2 and M.06.02-3, respectively.

- C. **Galvanizing:** Zinc (hot-galvanized) coatings on structural steel, shear connectors, anchor rods (as required), high strength bolts, and washers shall meet the requirements of CTDOT Form 816 Article M.06.03.
- D. **Concrete for Platform Sections:** Concrete for the platform sections shall be of the type and strength designated on the plans and shall conform to the pertinent requirements of CTDOT Form 816 Section 5.14 and Article M.14.01.
- E. **Reinforcing Steel:** All reinforcing steel shall be epoxy coated and of the type and size designated on the plans and shall conform to the pertinent requirements of CTDOT Form 816 Section M.06.01.
- F. **HSS (Hollow Structural Sections):** HSS for the platform panel joint connections shall be galvanized and of the size designated on the plans and shall conform to the requirements of ASTM A1085.
- G. **Non-Shrink Grout:** Non-shrink grout for the platform panel joint connections shall conform to the requirements of CTDOT Form 816 Article M.03.05.
- H. **Threaded Inserts for Hold Down Clamps:** Threaded inserts for the hold down clamps shall be galvanized and conform to the requirements of CTDOT Form 816 Article M.14.01-6.
- I. **Stainless Steel Anchor Rods and Threaded Inserts for Polyethylene Rub Rails:** The anchor rods for supporting the polyethylene rub rail units to be installed on the track side vertical edge of the platform sections shall be 5/8" diameter ASTM A240 Type 304 stainless steel with washer, nut, and nylon lock nut. The stainless steel threaded inserts shall be compatible with the anchor rods and of the type recommended by the rub rail manufacturer.
- J. **Premolded Pads:** Premolded pads shall conform to the requirements of CTDOT Form 816 Article M.17.01.
- K. **Other Materials:** All other materials shall meet the requirements specified in the contract documents and are subject to the approval of the Engineer.

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS

- A. **Platform Sections:** The construction methods associated with fabricating, transporting, storing, handling, and erecting all the elements that make up the platform sections shall conform to the applicable requirements of the CTDOT Form 816 sections outlined in this specification.
 - 1. Panel joint connections shall be constructed as indicated on the plans.
- B. **Precast Platform Panels:** The construction methods associated with fabricating, transporting, storing, handling, and erecting the precast platform panels (for the platform sections) shall conform to the applicable requirements of CTDOT Form 816 Section 5.14.

1. **Concrete for Precast Platform Panels:** The construction methods associated with the precast platform panel concrete shall conform to the pertinent requirements of CTDOT Form 816 Section 5.14.03.
 2. **Reinforcing Steel for Precast Platform Panels:** The construction methods associated with the precast platform panel reinforcing steel shall conform to the pertinent requirements of CTDOT Form 816 Section 6.02.
 3. **HSS for Precast Platform Panel Joint Connections:** HSS shall be cast within the precast platform panels as designated on the plans.
 4. **Rejection of Precast Platform Panels:** Any precast platform panels not fabricated in accordance with the contract documents shall be subject to rejection.
 5. **Marking of Precast Platform Panels:** Each precast platform panel shall be clearly and permanently labeled on the underside of the panel in accordance with the pertinent requirements of CTDOT Form 816 Section 5.14.03-11.
 6. **Precast Platform Panel Fabrication Tolerances:** Precast platform panels shall be fabricated and comply with the tolerances designated on the plans.
 7. **Layout of the Precast Platform Panels:** The panel fabricator shall supply to the Contractor detailed as-built plans of the fabricated precast platform panels. The Contractor shall lay out fabricated panels in accordance with the as-built drawings to facilitate proper fitting of the panels during erection.
- C. **Structural Steel, Anchor Bolts, and High Strength Bolts:** The construction methods associated with the structural steel, anchor bolts, and high strength bolts (for the platform sections) shall conform to the pertinent requirements of CTDOT Form 816 Section 6.03.03. All structural steel to be embedded in concrete shall be clean and free from dirt, oil, grease or paint.
- D. **Field Inspection:** The Contractor shall provide the Engineer with all facilities necessary to conduct thorough inspection of all the erection work associated with the platform sections.
- E. **Bearing Surfaces:** Bearing surfaces shall be properly finished to the correct elevation to provide full and even supporting surfaces for the structural steel girder bearings.

END OF SECTION 03 41 05

SECTION 03 53 20 – MICROSILICA CONCRETE OVERLAY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Drawings and general provisions of the Contract, including General Conditions of Division 1, State of Connecticut, Department of Transportation, Standard Specifications for Roads, Bridges, and Incidental Construction, Form 816 – 2004 and supplemental specifications thereto, shall be a part of this specification.

1.2 SUMMARY

- A. This section specifies requirements for cast-in place microsilica concrete to be placed as an overlay to the precast concrete platform slabs and includes the following:
 - 1. Performance requirements for the production of high strength concrete overlay with microsilica (silica fume) admixture for the reduction of concrete permeability to protect against intrusion by chlorides and other aggressive chemicals.
 - 2. Cleaning, surface preparation, furnishing, placing, finishing and curing of the microsilica concrete (MSC), saw cutting and installing joints, and final clean-up.
 - 3. Microsilica concrete overlay shall be provided where indicated on the contract drawings or as directed by the Engineer.
 - 4. MSC overlay shall vary in thickness as indicated in the contract drawings.
 - 5. Any damage to adjacent or remaining structures caused by Contractor's operations will be repaired by the Contractor at his expense in a manner approved by the Engineer.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations for each material indicated.
- B. Field quality-control test reports.
- C. Product Test Reports: Submit independent test data by a qualified testing agency substantiating the product's ability to reduce concrete permeability by chlorides and other aggressive chemicals.
- D. Minutes of preinstallation conference.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
- B. Manufacturer: Concrete admixtures shall be manufactured by a firm with a minimum of 5 years experience in the production of similar products. Manufacturers proposed for use but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past five years.
- C. Materials: For each type of material required for the work of this Section, provide primary materials which are the products of one manufacturer.
- D. Pre-Installation Conference: A pre-installation conference shall be held two weeks prior to commencement of field operations to install the specified project in order to establish procedures, maintain optimum working conditions and coordinate this work with related and adjacent work. Agenda for meeting shall include concrete and admixture handling, placing, finishing, and curing. Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."
- E. Manufacturer's Representative: A representative of the manufacturer shall be present for project start-up during initial concrete placement. Engineer may waive requirement for manufacturer's representative if Contractor provides sufficient evidence that producer and finisher have adequate experience with admixtures required.
- F. Trial Mix: Provide a minimum 4 cubic yard (3 m³) trial mix containing proposed concrete design mix placed at the job site in a location acceptable to the Engineer. Engineer may waive requirement for the trial mix if Contractor provides sufficient evidence that producer and finisher have adequate experience with low water cement ratio mixes.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage, mixing with other components, and application.
- B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting concrete overlay performance.
 - 1. Place concrete overlay only when ambient temperature and temperature of base slabs are between 50 and 86 deg F or as required by the manufacturer.
- B. Close areas to traffic during topping application and, after application, for time period recommended in writing by manufacturer.

PART 2 – PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Epoxy-Coated Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars, ASTM A 775/A 775M or ASTM A 934/A 934M, epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length.
- B. Epoxy-Coated Wire: ASTM A 884/A 884M, Class A. Type 1 coated, plain-steel wire, with less than 2 percent damaged coating in each 12-inch wire length.
- C. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884/A 884M, Class A coated, Type 1, deformed steel.

2.2 REINFORCEMENT ACCESSORIES

- A. Epoxy Repair Coating: Liquid two-part, epoxy repair coating: compatible with epoxy coating on reinforcement and complying with ASTM A 775A/ 775M.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
 - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric polymer-coated wire bar supports.

2.3 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project.
 - 1. Portland Cement: ASTM C 150, Type I/II, gray. Supplement with the following:
 - a. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

- B. Silica Fume: ASTM C 1240, amorphous silica.
- C. Normal-Weight Aggregates: ASTM C 33, Class 3S course aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 - 1. Maximum Coarse-Aggregate Size: 3/8 inch nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Water: ASTM C 94/C 94M and potable.

2.4 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. High-Range. Water-Reducing Admixture: ASTM C 494/C 494M, Type F.

2.5 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming: manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Portable.

2.6 RELATED MATERIALS

- A. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A Shore durometer hardness of 80 per ASTM D 2240.
- B. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- C. Portland Cement: ASTM C 150, Type I or II.
- D. Sand: ASTM C 404, fine aggregate passing No. 16 sieve.
- E. Water: Portable.
- F. Acrylic-Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

- G. Epoxy Adhesive: ASTM C 881, Type V. two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suite requirements.

2.7 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:
 - 1. Silica Fume: 10 percent.
 - 2. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
 - 3. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use high-range water reducing or plasticizing admixture in concrete, as required, for placement and workability.

2.8 CONCRETE MIXTURES FOR MICROSILICA CONCRETE OVERLAY

- A. Microsilica Concrete Overlay: Proportion normal-weight concrete mixture with microsilica to meet the following performance criteria:
 - 1. Minimum Compressive Strength: 5000 psi at 28 days.
 - 2. Maximum Permeability: 800 coulombs at 56 days, ASTM C 31 & ASTM C 1202
 - 3. Minimum Bond strength: 150 psi at 28 days. ASTM C1042
 - 4. Maximum Water-Cementitious Materials Ratio: 0.40.
 - 5. Minimum Cementitious Materials Content: 700 lb/cu. yd. for 3/8" maximum aggregate.
 - 6. Slump Limit: 6 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
 - 7. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/8-inch nominal maximum aggregate size.
- B. Microsilica, fly ash, blast furnace slag and cement are considered cementitious materials in calculations.
- C. Add microsilica as a liquid slurry or in dry densified form in 25 lb Concrete Ready Bags packaging. The water content of slurry shall be included as mix design water.

- D. Blended cements with interground microsilica will not be allowed.
- E. Air Entrainment: For freeze-thaw durability comply with ACI 318 freezing and thawing exposure requirements, as determined by ASTM C 173 or ASTM C 281.
- F. Concrete Admixtures: High-range water reducers meeting the requirements of ASTM C494, Type F are required to control slump, mixing, cementitious ratio and proper distribution of the microsilica, and shall be plant added. Additional water reducers may be added at the job site when required.
- G. Additional Concrete Admixtures: Additional concrete admixtures conforming to ASTM C 494 or equivalent CSA 266 standards may be used as required.

2.9 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.10 CONCRETE MIXING

- A. Microsilica Concrete shall be mixed in transit mixers only in accordance with microsilica manufacturer's written requirements.
- B. Ready-Mixed Concrete: Measure, batch, mix and deliver concrete according to ASTM C 94/C 94M except as noted below, and furnish batch ticket information.
- C. Special Mixing Requirements for Densified Microsilica: Densified microsilica requires enhanced mixing to ensure full dispersion. The following mix requirements shall be adhered to:
 - 1. For all types of mixing equipment, mix times shall be increased by 40% over the minimum mix time required to achieve mix uniformity as defined by ASTM C 94.
 - 2. For truck-mixed and central mixed concrete, maximum allowable batch size shall be 80% of the maximum as called out by ASTM C 94.

PART 3 – EXECUTION

1.1 EXAMINATION

- A. Examine substrates, with Installer present, for conditions affecting performance of concrete overlay.
- B. Verify that base concrete slabs comply with scratch finish requirements specified in Division 3 section "Cast-in-Place Concrete."
- C. Notify Engineer in writing of circumstances detrimental to the proper completion of the work.
- D. Proceed with application only after unsatisfactory conditions have been corrected.

1.2 EQUIPMENT

- A. Microsilica concrete shall be mixed by transit mixers only.
- B. Equipment used shall supply air and water free of oil so as not to contaminate the deck surface. (i.e. equipment with oil trap).

1.3 PREPARATION

- A. Existing Concrete: Remove existing surface treatments and deteriorated and unsound concrete. Ensure that base slabs exhibit a heavily scarified surface profile with an amplitude of 1/4 inch.
 - 1. Prepare and clean existing base slabs. Fill voids, cracks, and cavities in base slabs.
 - 2. Surface to receive MSC shall be cleaned no more than 24 hours prior to placement of overlay. The surface may require additional cleaning if placement is delayed.
 - 3. Entire surface shall be cleaned by high-pressure water blasting or other approved method to remove any curing compound, loose concrete, laitance, oil or any other residue or contaminate that may be detrimental to achieving bond.
 - 4. The surface shall be protected after cleaning but before placement of the MSC by covering all surfaces to receive the overlay with a minimum 6mil thick polyethylene film.
 - 5. The concrete deck surface to receive the overlay shall be wetted for 12 hours prior to placement of the MSC or as required by the manufacturer of the bonding agent. Standing water shall be blown clear prior to placement of the overlay.
- B. Install joint-filler strips where topping abuts vertical surfaces, such as columns, edging plates and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with topping surface, unless otherwise indicated.
 - 2. Terminate full-width, joint-filler strips, 1/2 inch below topping surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated.
 - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- C. Epoxy-Coated Reinforcement: All reinforcing steel shall be epoxy coated. All reinforcing steel in contact with the overlay shall be cleaned of dirt, grease, concrete mortar and loose rust prior to placement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement. All damage to the epoxy coating shall be repaired prior to concrete placement.

3.4 OVERLAY APPLICATION

- A. Start overlay application in presence of manufacturer's technical representative.
- B. Existing Concrete: Apply bonding adhesive, mixed according to manufacturer's written instructions, and scrub into dry base slabs to a thickness of 1/16 to 1/8 inch, without puddling. Place overlay while adhesive is still tacky. All surfaces in contact with the microsilica concrete shall be evenly coated. No excess bonding adhesive shall be allowed to collect in pockets.

- C. The application of bonding adhesive shall be limited to an area that can easily be covered with the MSC overlay before the adhesive begins to dry. If the Engineer determines that the bonding adhesive has dried before the application of the MSC, the contractor shall clean and re-prepare the surface as described above.
- D. The MSC overlay and bonding adhesive shall not be placed in the rain.
- E. Place concrete overlay continuously in a single layer, tamping and consolidating to achieve tight contact with bonding surface. Do not permit cold joints or seams to develop within pour strip.
 - 1. Screed surface with a straightedge and strike off to correct elevations.
 - 2. Slope surfaces uniformly where indicated.
 - 3. Begin initial floating using bull floats to form a uniform and open-textured surface place free of bumps or hollows.
- F. Concrete Cover: Minimum concrete cover over reinforcement shall be 1 ½".
- G. Finishing: Underfinish microsilica concrete by limiting finishing operation to screeding, bull-float, and broom finish. Curing shall be initiated within one hour of concrete placement.
 - 1. Finish and measure surface so gap at any point between surface and an unleveled freestanding 10-foot-long straightedge, resting on 2 high spots and placed anywhere on the surface, does not exceed ¼ inch.
- H. Expansion/Construction Joints: Construct joints true to line with faces perpendicular to surface plane of concrete overlay, at locations indicated or as approved by Architect.
- I. Contraction Joints: Form weakened-plane contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints onto concrete overlay when cutting action will not tear, abrade, or otherwise damage surface and before random contraction cracks develop.
 - 1. Form joints in concrete overlay over expansion/construction joints in base slabs, unless otherwise indicated.
 - 2. Construct contraction joints for a depth equal to one-fourth of concrete overlay thickness, but not less than ½ inch deep.

3.5 PROTECTING AND CURING

- A. General: Protect freshly placed concrete overlay from premature drying and excessive cold or hot temperatures.
- B. Wind breaks, sun shades, and fog misting may be utilized to minimize the rate of evaporation at the concrete surface.
- C. Fog misting shall be provided when the rate of evaporation at the concrete surface exceeds 0.1 pound per square foot per hour as determined by ACI 308 Section 1.2.1. Fogging shall continue
- D. Evaporation Retarder: Apply evaporation retarded to concrete overlay surfaces in hot, dry or windy conditions before and during finishing operations. Apply according to manufacturer's

written instructions after placing, screeding, and bull floating and during final finish to protect the concrete.

- E. Begin curing immediately after finishing concrete overlay. Cure by one or a combination of the following methods, according to microsilica manufacturer's written instructions.
 - 1. Moisture Carding: Keep surfaces continuously moist with water-fog spray and absorptive cover. The MSC shall be wet cured with prewetted burlap for a minimum of 7 days. The burlap shall be lapped a minimum of 12 inches and shall be protected from displacement. The burlap shall be presoaked for a minimum of 24 hours and shall be drained of excess water prior to application.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
- F. Protect completed work from damage and construction operations throughout finishing and curing operations.
- G. Removal of the burlap should be done late in the day so as to reduce the thermal shock to the overlay.

3.6 JOINT FILLING

- A. Prepare and clean contraction joints and install semirigid joint filler, according to manufacturer's written instructions, once topping has fully cured.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth of contraction joints. Overfill joint and trim semirigid joint filler flush with top of joint after hardening.

3.7 REPAIRS

- A. Defective Topping: Repair and patch defective concrete overlay areas, including areas that have not bonded to concrete substrate.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Services: Testing and inspecting of completed applications of concrete overlays shall take place in successive stages, in areas of extent and using methods as follows:

1. Sample Sets: At point of placement, a set of 4 molded-cube samples shall be taken from the topping mix for the first 1000 sq. ft. plus 1 set of samples for each subsequent 5000 sq. ft. of topping, or fraction thereof, but not less than 6 samples for each day's placement. Samples shall be tested according to ASTM C 109/C 109M for compliance with compressive-strength requirements.
 2. Concrete overlay shall be tested for delamination by dragging a steel chain over the surface.
 3. Concrete overlay shall be tested for compliance with surface flatness and levelness tolerances.
- C. Remove and replace applications of concrete overlay where test results indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

SECTION 03 53 20

SECTION 05 52 00 - METAL HANDRAIL AND GUARDRAIL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 General Requirements, apply to this Section.

1.2 SUMMARY

- A. **The work specified in this Section consists of furnishing and installing metal handrails, guardrails and railings as shown and as indicated on the Contract Drawings, including, but not limited to:**
 - 1. Powder-Coated Galvanized Steel Guardrails
 - 2. Anodized Aluminum Handrails
 - 3. Powder-Coated Galvanized Steel Handrails

1.3 PERFORMANCE REQUIREMENTS

- A. **American Society for Testing and Materials (ASTM):**
 - 1. A36, Specification for Carbon Structural Steel.
 - 2. A53, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - 3. A153, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 4. A307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
 - 5. A320, Specification for Alloy Steel Bolting Materials for Low-Temperature Service.
 - 6. A449, Specification for Quenched and Tempered Steel Bolts and Studs.
 - 7. A563, Specification for Carbon and Alloy Steel Nuts.
 - 8. E935, Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
- B. **American Welding Society (AWS):**
 - 1. ANSI/AWS D1.1 - Structural Welding Code.

C. **Steel Structures Painting Council (SSPC):**

1. Steel Structures Painting Manual, Volume 2, "Systems and Specifications".

1.4 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.5 SUBMITTALS

A. **Submit the following:**

1. Shop Drawings: Show plans and sections; materials of construction; finishes; methods of fastening; locations of cuts, copes, connections, holes, and threaded fasteners; methods of joining components; type, size, and spacing of welds; and proposed marking of fabrications which will require field assembly.
2. The contractor has an absolute obligation to meet all applicable codes controlling the fabrication and installation of handrails and guardrails. Shop drawings which either omit information or show information which is in violation of applicable codes will not, even if approved, allow the contractor to install components which will not meet code. Any railing which does not conform to the applicable codes will be removed and replaced at no cost to owner.
3. Copies of manufacturer's catalog cuts and specifications for all products listed, including but not limited to mechanically connected railings and guardrails, railing brackets, grout, anchoring cement, and paint.
4. Certificates of welders' qualifications showing date of qualification, qualification grade and rating, and notarized signature of inspector.

- B. **Delegated-Design Submittal:** For railings, including structural calculations signed and sealed by the qualified professional engineer licensed in the state of Connecticut responsible for their preparation.

- C. **Samples:** Provide (3) 6" long or square samples which will show adequately the quality of fabrication and finish as specified herein. All finishes on the delivered products shall be judged against these samples. Half the guardrail sample shall be bare galvanized finish while the

remaining half will be painted over the galvanized finish to show both the galvanization and painting qualities.

1. Provide (3) samples of elbow, and tee, connections along with wall brackets, escutcheon, and end stops for the handrails.
2. Provide (3) samples of all fasteners including, washers, threaded rods, bolts, and nuts.

D. **Qualification Data:** For testing agency.

E. **Product Test Reports:** For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

F. **Evaluation Reports:** For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

A. **Installer Qualifications:** Installer of metal handrail and guardrail systems is a certified installer with documented history installing manufacturer's products according to manufacturer's specifications.

B. **Welding Qualifications:** Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

C. **General:** In engineering handrails and railings to withstand structural loads indicated, determine allowable design working stresses of handrail and railing materials based on the following:

1. Stainless Steel: ASCE 8, "Specification for the Design of Cold-Formed Stainless Steel Structural Members."
2. Structural Steel: AISC S335, "Specification for Structural Steel Buildings Allowable Stress Design and Plastic Design with Commentary."

D. **Structural Performance of Handrails and Railings:** Provide handrails and railings complying with requirements of ASTM E 985 for structural performance, based on testing performed according to ASTM E 894 and ASTM E 935.

E. **Structural Performance of Handrails and Railings:** Provide handrails and railings capable of withstanding structural loads required by ASCE 7 without exceeding allowable design working stresses of materials for handrails, railings, anchors, and connections.

F. **Structural Performance of Handrails and Railings:** Provide handrails, railings, and attachments capable of withstanding the following structural loads without exceeding allowable

design working stresses of materials for handrails, railings, anchors, and connections:

1. Top Rail of Guards: Capable of withstanding the following loads applied as indicated:
 - a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
 - b. Uniform load of 50 lbf/ft. (730 N/m) applied horizontally and concurrently with uniform load of 100 lbf/ft. (1460 N/m) applied vertically downward.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
2. Handrails Not Serving As Top Rails: Capable of withstanding the following loads applied as indicated:
 - a. Concentrated load of 250 lbf (890 N) applied at any point and in any direction.
 - b. Uniform load of 50 lbf/ft. (730 N/m) applied in any direction.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
3. Infill Area of Guards: Capable of withstanding a horizontal concentrated load of 250 lb applied to 1 sq. ft. (0.09 sq. m) at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area.
 - a. Load above need not be assumed to act concurrently with loads on top rails in determining stress on guard.
4. Where guard and handrails shall be installed in close proximity to overhead or third rail electrical services the assemblies shall be properly grounded and bonded by the electrical contractor. Note however, that the fabricator shall only be responsible for providing tabs, (2) per guard / handrail assembly, located at both ends of the bottom horizontal tube for the attachment of grounding cables. The responsibility for the installation of the hand and guardrails per the Electrical Drawings so that grounding and bonding will function as intended shall be the responsibility of the general contractor.

G. **Field Measurements:** Where handrails and railings are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating handrails and railing systems without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions.
2. When steel fabrication will be installed into an existing structure, or where the guard and handrail are configured different from the standard platform module layouts; "A," "B," "C," and "D," as shown on the standard guard/handrail drawings then field measurements for shop drawings shall be required prior to beginning fabrication.

3. Any discrepancies between the drawings and what is in the field shall be brought to the attention of the project manager. It is assumed that slight variation may exist and this is to be expected. Extras associated with discrepancies shall only be granted where these discrepancies can be proved to be a major consequence on the design and fabrication.

H. **Thermal Movements:** Provide handrails and railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

I. **Control of Corrosion:** Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.8 WARRANTY

- A. All components shall be warranted for 5 year against frame failure, mill scale, rusting, corrosion, rust stains, chipping, peeling, and/or paint discoloration and/or fading.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel:

1. Steel Pipe for Railings and Pipe Supports: Seamless steel pipe, conforming to ASTM A53, Type S, Grade A; 1-1/2 inch diameter; standard weight. Provide special instructions to the pipe manufacturer to provide Architectural Handrail Grade Pipe.
2. Tubing: ASTM A 500 (cold formed) or ASTM A 513
3. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
 - a. Provide galvanized finish for exterior installations and where indicated.
4. Plate: Steel plate for anchor plates shall be standard steel plate, conforming to ASTM A36, weldable quality.

- B. **Aluminum, General:** Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
1. Extruded Tubing: ASTM B 221, Alloy 6063-T5/T52.
 2. Extruded Structural Round Tubing: ASTM B 429/B 429M, Alloy 6063-T6.
 - a. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.
 3. Drawn Seamless Tubing: ASTM B 210 (ASTM B 210M), Alloy 6063-T832.
- C. **Welding Electrodes and Filler Metal:** The Contractor shall use the type and alloy of filler metal and electrodes recommended by the producer of the metal to be welded, and as required to match colors, and strength and for compatibility with the individual components of fabricated items.
- D. **Anchors, Fasteners, and Accessories:** Provide all required anchors, fasteners, miscellaneous components, and accessories as required for complete and finished railing installations. Bolts and studs, nuts, and washers shall conform to ASTM A307, A449, and A563.
1. Expansion Bolts: Where anchors are not included in the concrete construction, provide stainless steel expansion type anchors with matching stainless steel bolts or studs with nuts, of sizes as indicated or required. Provide washers under all bolt heads and nuts.
- E. **Handrail Brackets:** stainless steel tubing, ASTM A 554, Grade MT 316L.
1. Provide non-metallic isolators between aluminum and all ferrous metals.
- F. **Powder-Coat Finish:** Prepare, treat, and coat galvanized metal to comply with resin manufacturer's written instructions and as follows:
1. Prepare galvanized metal by thoroughly removing grease, dirt, oil, flux, and other foreign matter.
 2. Treat prepared metal with zinc-phosphate pretreatment, rinse, and seal surfaces.
 3. Apply thermosetting polyester. Gloss 60+/-5 units. Bake 10 minutes at 400 degrees Fahrenheit.
 4. Color: Vulcan Black SD, P6SB56
- G. **Fasteners for Anchoring Railings to Other Construction:** Select fasteners of the type, grade, and class required to produce connections that are suitable for anchoring railing to other types of construction indicated and capable of withstanding design loadings.
1. Provide fasteners fabricated from stainless steel, type 316
- H. **Fasteners for Interconnecting Railing Components:** Use fasteners of same basic metal as the fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible

with materials joined.

1. Provide concealed fasteners for interconnecting handrail and railing components and for attaching them to other work, except where otherwise indicated.
2. Provide concealed fasteners for interconnecting handrail and railing components and for attaching them to other work, except where exposed fasteners are unavoidable or are the standard fastening method for handrail and railing system indicated. Provide tamper resistant machine screws for exposed fasteners, unless otherwise indicated.
3. Provide non-metallic isolators between aluminum and all ferrous metals.
4. All exposed fasteners shall be tamper resistant.

2.2 MISCELLANEOUS MATERIALS

- A. **Welding Rods and Bare Electrodes:** Select according to AWS specifications for metal alloy welded.
 1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. **Bituminous Paint:** Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- C. **Nonshrink, Nonmetallic Grout:** Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for exterior applications.
- D. **Anchoring Cement:** Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 1. **Water-Resistant Product:** At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.3 FABRICATION

- A. **General:** Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Fabricate pipe railings to dimensions and details indicated with smooth bends and to other requirements specified herein.
- C. **Welded Connections:** Fully weld connections, heat and bend bends without distorting metal. Cope intersections of rails and posts, weld joints and grind smooth. Butt-weld end-to-end joints

of railings. In all cases, fabricate top rail continuous over posts, and posts continuous from base to top rail. Welding procedures and welding operations shall conform to, and welders and tackers shall be qualified, in accordance with ANSI/AWS D1.1.

- D. **Welded Connections for Aluminum Pipe:** Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.
- E. Form exposed work to line and level with angles and surface and with straight sharp edges. Ease exposed edges to radius of approximately 1/32 inch unless otherwise shown. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.
- F. Form exposed connections with hairline joints to exclude water and which are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type shown, or if not shown, Phillips flathead (countersunk) screws or bolts.
- G. Assemble railing systems in shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- H. **Form changes in direction of railing members as follows:**
 - 1. By radius bends of radius indicated.
 - 2. By flush radius bends.
 - 3. By bending.
 - 4. By mitering at elbow bends.
 - 5. By insertion of prefabricated flush elbow fittings.
 - 6. By any method indicated above, applicable to change of direction involved.
- I. **Brackets, Flanges, Fittings, and Anchors:** Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
- J. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain profile of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.
- K. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- L. **Fabrication Tolerances:**

1. Max. Bow and Camber: 1/8" in 8 feet.

2. Max. Misalignment: 1/16" in 8 feet.

2.4 GALVANIZED STEEL FINISH

A. **Galvanized Guardrails and Handrails:**

1. Hot-dip galvanize steel railings, including hardware, after fabrication.

2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.

3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.

4. Do not quench or apply post galvanizing treatments that might interfere with powder-coat adhesion.

5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

C. **Preparing Galvanized Railings for Shop Priming:** After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

2.5 ALUMINUM FINISH

A. **Appearance of Finished Work:** Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. **Clear Anodic Finish:** AAMA 611, AA-M12C22A41

2.6 CLEANING

A. **Corrosion Control:** Apply corrosion inhibitor to railing surface that will abut surfaces constituted of material other than that of the fabricated metal product.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Install metal handrails and guardrails in accordance with the Contract Drawings and the

approved shop drawings.

- B. Install metal handrails and guardrails with accessories furnished by the railing fabricator as required for complete and finished railing installations.
- C. Install handrails and guardrails in accordance with approved shop drawings, true and horizontal, perpendicular, or at the required angle, as the case may be, level and square, with angles and edges parallel with related lines of the building or structure.
- D. Adjust railing prior to securing in place to ensure proper matching of butting joints and correct alignment throughout their length. Secure posts not more than 8 feet on center, unless otherwise indicated. Plumb posts in each direction.
- E. **Secure posts and rail ends as follows:**
 - 1. Installation in new concrete:
 - a. Set posts in sleeves which have been set in concrete, and grout posts therein with non-shrink grout.
 - 2. Anchor rail ends into concrete and masonry with steel round flanges welded to rail ends and anchored into the wall construction with expansion bolts.
 - 3. Anchor rail ends to steel with steel oval or round flanges welded to rail ends and bolted to the structural steel members, unless otherwise indicated.
 - 4. Provide removable railing sections as indicated. Furnish slip-fit metal socket or sleeve for casting into concrete. Accurately locate sleeve to match post spacings.
- F. **Other than field welded connections:**
 - 1. Assemble connections end-to-end and splice joints with internal sleeves.
 - 2. Fitting assembly:
 - a. Assemble pipe at joints and drive together within 0.02 inch.
 - b. Assemble fittings into posts before pressing rails into fittings.

3.2 PREPARATION

- A. Comply with AWS code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.
- B. All welds shall be subjected to a visual inspection by an independent inspection agency, provided by and paid by the Contractor, for conformance with ANSI/AWS D1.1.

3.3 INSTALLATION, GENERAL

- A. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.
- B. Clean aluminum and stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.

3.4 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 05 52 00

SECTION 05 55 13 – METAL STAIR TREADS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 General Requirements, apply to this Section.

1.2 SUMMARY

A. **This section includes the following:**

- 1. Furnish all labor, materials, tools and equipment, and perform all operations related to abrasive stair treads, set in locations as indicated on the Contract Drawings and herein specified. Work includes:
 - a. Furnish and install abrasive cast aluminum treads

B. **Related Sections:**

- 1. Section 03 30 00 Cast in Place Concrete

1.3 COORDINATION

- A. Coordinate installation of anchorages for metal stair treads. Furnish setting drawings, templates, and directions for installing anchorages, concrete inserts, anchor bolts, and items with integral anchors that are to be embedded in concrete or masonry.

1.4 SUBMITTALS

- A. Submit shop drawings showing plan and installation details including fastening for review.
- B. Submit manufacturer's specifications, product data, and installation instructions for review.
- C. Warranty Certificate.

1.5 QUALITY ASSURANCE

- A. Metal stair treads shall be in compliance with Department of Transportation ADA Standards for Transportation Facilities (2006 edition).

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials as recommended by the Manufacturer, to protect from damage.

1.7 WARRANTY

- A. Manufacturer's standard warranty: Products will be free of manufacturing and material defects. Any defective product will be replaced or repaired free of any charge. Claim have to be brought to manufacturer's attention, in writing, within *One Year* following the date of Final Acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. List of recommended manufactures:

1. Safe-T-Metal Company, Inc., Aluminum, Style B4
2. Wooster Products Inc., ALUMOGRIT; Type 101
3. Westfield Sheet Metal Works, Inc
4. American Safety Tread Co, Inc., ALUMACAST
5. American Abrasive Metals Company; Style A.
6. Or Engineer's Approved Equal

2.2 MATERIALS

A. Provide Cast Aluminum abrasive stair treads and landings, 3/8" thick for all stairs:

1. Abrasive shall be #20 virgin grain Aluminum Oxide (AL₂O₃) abrasive, integrally cast into the walking surface to a minimum depth of 1/32 inch (0.79 mm).
2. Concealed type anchors shall be slotted rivet type, integrally cast into the body of the nosing a minimum of 3/8". (Not mushroom type.)
3. Cast metals used shall conform to the following specification:
 - a. Abrasive Cast Aluminum:
 - 1) No. 43 prime and secondary ingot; low copper content; corrosion resistant.
4. Any holes or countersinks shall be machine-made; cored holes or countersinks are not acceptable. Screw heads shall not protrude above tread surface.

5. Cross hatching and fluting shall be 1/16 inch (1.59 mm) deep minimum and shall be clean and well defined; treads and nosing's shall be manufactured, packed and shipped so as to arrive at the jobsite in good condition.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Transmit Submittals required by this Section
- B. Furnish products as indicated
- C. Ensure substrates are in suitable condition to receive work.
 1. Installer shall examine conditions under which work is to be performed and shall notify the contractor in writing of unsatisfactory conditions. Installer shall not proceed until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.2 INSTALLATION

- A. Install stair nosings in accordance with the governing regulations, the industry standards applicable to the work, and the manufacturer's written installation instructions.
- B. Work shall be aligned plumb, level, and, where required, flush with adjacent surfaces and rigidly anchored to the substrate.
- C. Treads shall be installed in accordance with the manufacturer's instructions.
- D. At the completion of the work, all damaged, improperly installed and marred work shall be replaced or repaired to the satisfaction of the Engineer.
- E. Nosings shall terminate not more than 3" from ends of steps for poured concrete stairs; for steel stairs, nosings shall be full length of steps less 1/8" (3.05 mm) clearance.
- F. NOTE: Safety nosing's going into new poured concrete or cement fill shall be installed before "Initial Set" of the concrete or cement occurs.

3.3 CLEANING

- A. Clean exposed surfaces as recommended by the manufacturer.

3.4 PROTECTION

- A. Contractor is to coordinate work within this Section with work of other Sections during the remainder of construction. Protect work within this Section to prevent damage.

- B. Finished units shall be without damage. Units damaged during shipping or construction shall be repaired by the contractor at the expense of the party damaging the material, in accordance with the contract requirements.

END OF SECTION 05 55 13

SECTION 06 64 00 - POLYETHYLENE RUB RAIL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work under this item shall consist of furnishing, transporting, storing, handling, and installing polyethylene rub rail units on the track sides of the proposed platform sections. The work shall be performed in accordance with the plans and these specifications. This work includes all necessary materials and equipment to complete the work as shown on the plans, including all stainless steel anchor bolts.
- B. The silicone joint sealant between the polyethylene rub rail units and both the cast-in-place microsilica concrete platform overlay (Section 03 53 20) and railroad platform waterproofing (Section 09 67 10) shall be furnished and installed in accordance with the CSI-formatted specification SECTION 07 92 05 - CONCRETE OVERLAY JOINT.

1.1 SUBMITTALS

- A. **Shop Drawings:** The Contractor shall submit shop drawings addressing all the elements that make up the polyethylene rub rail units, in accordance with the pertinent requirements of CTDOT Form 816 Sections 5.14.03-1 and 6.03.03-2, and the NOTICE TO CONTRACTOR – SUBMITTALS, and the following.
 - 1. At a minimum, the Shop Drawings shall include the following information:
 - a. Layout plan indicating unit dimensions, hole and groove spacing and dimensions, lengths of units, and fastening schedule.
 - b. Product data for review and approval.

1.2 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Rub Rail Units: 4 full-length pieces.
 - 2. Hardware: Adequate hardware for the replacement of four pieces.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain products from a single manufacturer.

- B. The coefficient of thermal expansion in degrees Fahrenheit, tested in accordance with ASTM D696, shall not be greater than:

1. 0 to 75 degrees: 1.1×10^{-4} inches per inch
2. 75 to 120 degrees: 1.87×10^{-4} inches per inch

- C. Fabrication Tolerances:

1. The straightness tolerance on the concrete edge side of the rubbing board shall be 1/8 inch in a ten foot section.
2. The variation in width of the board shall not be more than 1/16 of an inch in any length section.
3. The Contractor shall coordinate the location of fasteners with the factory-drilled holes in the units prior to fabrication.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store in compliance with manufacturer's written instructions.

1.5 FIELD CONDITIONS

- A. Field Measurements: Verify all dimensions of related construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 POLYETHYLENE RUB RAIL UNITS

- A. Size and shape shall be as indicated on the Contract Drawings. The rub rail units shall be fire-retardant ultra-high molecular weight polyethylene bar stock. The top surface shall be scarified to create a non-slip surface.
1. Manufacturers: Subject to compliance with requirements, provide one of the following:
 - a. Units fabricated by Polymer Industries, 2926 South Steel, Tacoma, WA 98409 distributed by TriStar Engineered Plastic Solutions. Contact: Brian Parath, Branch Manager, TriStar Plastics Corp. telephone: 508.925.7409, bparath@tstar.com.
 - b. Approved Equal.

2. Cross Section Dimensions: As indicated on drawings.
 3. Holes for Fastening: Provide factory-cut recessed holes and spline grooves as described in the contract drawings or as recommended by the manufacturer.
 4. Lengths: Fabricate product to the maximum length possible to suit job conditions, but at least 10' - 0" long.
 5. Fasteners shall be Type 304 or Type 316 stainless steel.
 6. Exterior Surface: Non-yellowing, UV Stable surfaces all sides.
 7. Color: Safety Yellow.
 8. Dry Coefficient of Friction (traffic surface): 0.80
 9. Flammability: Flame Spread per ASTM E162-02: 35 Maximum Radiant Panel Index IS.
 10. Smoke Generation per ASTM E662
 - a. Flaming Mode: Specific Optical Density DS: 12 max., Maximum Specific Optical Density D_M : 430.
 - b. Non-Flaming Mode: Specific Optical Density DS: 8 max., Maximum Specific Optical Density D_M : 246.
 - c. Smoke Toxicity per ASTM E800:
 - 1) Carbon Monoxide (CO): 123 ppm max.
 - 2) Hydrogen Flouride (HF): 1.5 ppm max.
 - 3) Hydrogen Chloride (HCl): 12 ppm max.
 - 4) Hydrogen Cyanide (HCN): 2 ppm max.
 - 5) Nitrogen Oxides (NOX): 53 ppm max.
 - 6) Sulfur Dioxide (SO₂): 1 ppm max.
 - 7) Carbon Dioxide (CO₂): 10,000 ppm max.
- B. Centering Splines: Use manufacturers recommended fiberglass centering splines and type 304 stainless steel screws as recommended by the manufacturer, whichever is more stringent.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. The Contractor shall gauge the track side edge of the platform sections with the center line of track and dress the platform section edge to provide the proper train clearance as follows:
 - 1. If the centerline of the track is on a curve, this clearance shall be increased in accordance with AREMA clearance standards, unless other instructions are given on the Contract Drawings.
- B. Attach polyethylene rub rail units after platforms sections have been erected and properly leveled. Do not shim units.
- C. Install rub rail units true, straight, and plumb with no distortions.
- D. Attach polyethylene rub rail units to platform sections with approved stainless steel, corrosion proof anchor rods.
- E. Maintain uniform space between adjacent units and adjacent surfaces. Fill space with sealant as indicated on the plans.

3.4 ADJUSTING, CLEANING, AND REPLACEMENT

- A. Adjust rub rail units vertically to match dimensions indicated on the plans. Align individual pieces both horizontally and vertically within 1/16", with no more than 1/8" gap between pieces at butt joints.
- B. Adjust rub rail units to account for thermal expansion in the long direction of the unit. Cut units and install 1/8" gapped butt joints as required to prevent buckling of the units during expansions.
- C. Repair damaged and defective rub rail units to eliminate functional and visual defects; replace units where not possible to repair. Adjust joinery for uniform appearance.
- D. If the rub rail units are struck by railroad traffic prior to substantial completion, the Contractor shall repair or replace the units to the Engineer's satisfaction at the Contractor's expense.
- E. Remove smears as rub rail units are installed. Clean with solvent recommended by the rub rail manufacturer and then wipe with clean dry cloths until no residue remains.
- F. Clean rub rail units on exposed and semi exposed surfaces.

END OF SECTION 06 64 00

SECTION 07 62 00 – SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. **Section Includes:**

- 1. Formed wall sheet metal fabrications.

B. **Related Requirements:**

- 1. Section 13 34 19 – Pre-engineered platform shelters and windscreens

1.3 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 ACTION SUBMITTALS

A. **Product Data:** For each type of product.

- 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. **Shop Drawings:** For sheet metal flashing and trim.

- 1. Include plans, elevations, sections, and attachment details.
- 2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
- 3. Include identification of material, thickness, weight, and finish for each item and location in Project.
- 4. Include details for forming, including profiles, shapes, seams, and dimensions.

5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of special conditions.
10. Include details of connections to adjoining work.

C. **Samples for Initial Selection:** For each type of sheet metal and accessory indicated with factory-applied finishes.

1. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
2. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.
3. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

1.5 INFORMATIONAL SUBMITTALS

- A. **Qualification Data:** For fabricator.
- B. **Sample Warranty:** For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. **Maintenance Data:** For sheet metal trim, and its accessories, to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. **Fabricator Qualifications:** Employs skilled workers who custom fabricate sheet metal trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials

away from uncured concrete and masonry.

- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.9 WARRANTY

- A. **Special Warranty on Finishes:** Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

- 1. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. **General:** Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
 - B. **Thermal Movements:** Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
- 1. Temperature Change: 120 deg F ambient; 180 deg F material surfaces.

2.2 SHEET METALS

- A. **General:** Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
 - B. **Aluminum Sheet:** ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
- 1. Color Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 - a. Color: Black.

2.3 MISCELLANEOUS MATERIALS

- A. **General:** Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.
- B. **Fasteners:** Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
- C. **Elastomeric Sealant:** ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- D. **Bituminous Coating:** Cold-applied asphalt emulsion according to ASTM D 1187.
- E. **Asphalt Roofing Cement:** ASTM D 4586, asbestos free, of consistency required for application.

2.4 FABRICATION, GENERAL

- A. **General:** Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 - 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 - 2. Obtain field measurements for accurate fit before shop fabrication.
 - 3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 - 4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners

on faces exposed to view.

- B. **Fabrication Tolerances:** Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. **Expansion Provisions:** Form metal for thermal expansion of exposed flashing and trim.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- D. **Sealant Joints:** Where movable, non-expansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- E. **Seams for Aluminum:** Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.
- F. Do not use graphite pencils to mark metal surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
 - 1. Verify compliance with requirements for installation tolerances of substrates.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. **General:** Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

3. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 4. Torch cutting of sheet metal flashing and trim is not permitted.
 5. Do not use graphite pencils to mark metal surfaces.
- B. **Metal Protection:** Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. **Expansion Provisions:** Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
- D. **Fasteners:** Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.3 ERECTION TOLERANCES

- A. **Installation Tolerances:** Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

- B. **Installation Tolerances:** Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.4 CLEANING AND PROTECTION

- A. Clean off excess sealants.
- B. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturers written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.
- C. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 62 00

SECTION 07 91 15 – PLATFORM EXPANSION JOINT SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work under this item shall consist of furnishing and installing preformed polychloroprene (neoprene) compression joint seals of the open-cell compression type, at the locations and of the size shown on the plans, as directed by the Engineer and in accordance with these specifications.
- B. This specification also covers the lubricant-adhesive used when installing the seal.

1.2 SUBMITTALS

- A. A Materials Certificate will be required in accordance with CTDOT Form 816 Article 1.06.07 certifying the conformance of the platform expansion joint system components to the requirements set forth in this specification.

PART 2 - PRODUCTS

2.1 MATERIALS

A. **Preformed Polychloroprene Compression Joint Seal**

- 1. The preformed polychloroprene compression joint seal shall be manufactured from a vulcanized elastomeric compound using polymerized chloroprene as the only base polymer. Polychloroprene shall make up at least 50% of the compound used in the manufacture of the seal.
- 2. The compression joint seal shall be as follows or an approved equal:
 - a. Preformed Polychloroprene Compression Joint Seal, manufactured by:
 - 1) The D.S. Brown Company
300 East Cherry Street
North Baltimore, OH 45872
Phone: (419) 257-3561
- 3. Physical Properties:
 - a. The material shall conform to USACE CRD-C 548 for jet fuel and heat resistance.
 - b. The material shall conform to the physical properties prescribed in the table below (ASTM D2628 modified).

Property	Requirements	ASTM Method
Tensile Strength, min psi	2000	D412
Elongation at break, min %	250	D412
Hardness, Type A Durometer	60 \pm 5	D2240 a*
Oven Aging, 70 hrs. @ 212°F Tensile strength, loss, max., % Elongation, loss, max., % Hardness, Type A, points change	20 max. 20 max. 0 to +10	D573
Oil Swell, ASTM Oil IRM 903 70 hrs @ 212°F Weight change, max., %	45 max.	D471
Ozone Resistance 20% strain, 300 pphm, 70 hrs. @ 104°F	No cracks	D1149 b*

*a: The use of joint seal as the specimen source requires that more plies than specified in the procedure be used.

*b: Test in accordance with procedure A of D518.

4. Sampling:

- a. A lot shall consist of no more than one manufacturer's production day or 30,000 linear feet, whichever is less. Samples shall be taken at random from each lot to be shipped. A minimum of six linear feet shall constitute one sample for testing purposes.

5. Testing:

- a. Testing shall be completed on each lot by the manufacturer. Specimen preparation and testing shall follow the method explained in ASTM D2628 (modified). A copy of this method may be obtained from the manufacturer of the seal.

B. Lubricant Adhesive

1. The lubricant-adhesive used to install the preformed polychloroprene (neoprene) joint seal shall be a one-component Urethane compound. The lubricant-adhesive shall meet ASTM D4070 and shall have the following properties:

Lubricant-adhesive Properties
Solids Content 60%, by weight
The lubricant shall be uniform, contain no lumps, and have a drying time between ten and forty five minutes.
Viscosity shall be that the lubricant will perform suitably with the installation equipment.
The lubricant shall remain fluid from 5° to 120°F.
The lubricant should be kept from freezing and used within 360 days of manufacture.

- Each lot of lubricant-adhesive shall be delivered in containers plainly marked with the manufacturer's name and trademark, lot number and date of manufacture and shall be accompanied by the manufacturer's certification as to conformance to this specification.

C. Spall Repair Material

- Refer to "Repairing Spalls" under Section 3.1.A of this specification.

D. Storage and Shipment

- The preformed polychloroprene (neoprene) compression joint seal is delivered either in cardboard boxes or on wooden cable reels. The proper storage of the cardboard boxes requires that the boxes be protected from moisture to keep the cardboard from deteriorating. The large wooden cable reels should be covered by a tarpaulin to keep the seal clean and free of damage.
- The lubricant-adhesive shall be kept from freezing. The containers of lubricant-adhesive should be labeled with the manufacturer's name, catalog number, lot number and manufacture date. Also, an MSDS must accompany all shipments for the safety of the user.

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS

A. Installation:

- The platform expansion joints shall be installed at the locations shown on the plans and in stages in accordance with the plans.
- Tools, equipment, and techniques used to prepare the joints shall be approved by the Engineer and the manufacturer's technical representative prior to the start of construction.
- Before installation of the compression joint seal, the vertical surfaces in the expansion joint opening receiving the seal shall be cleaned of dust, dirt, debris and other loose

materials as recommended by the manufacturer. Additionally, the vertical surfaces shall be blast cleaned if recommended by the manufacturer.

4. The lubricant-adhesive is used mainly to facilitate the installation of the preformed polychloroprene (neoprene) compression joint seal. The lubricant-adhesive will begin to thicken at 40°F. When sealing operations occur where the air temperature falls below 40°F, the lubricant-adhesive must be stored in a heated warehouse until immediately prior to use. **The Contractor shall contact the compression seal manufacturer if installing seal when temperatures are below 32°F.**
5. Repairing Spalls: Some spall repair to the vertical concrete surfaces receiving the joint seal may be necessary. For small spalls (5/8" wide or smaller and less than 3" long) the contractor shall use Sika 1A (Black), Sika Non-Sag Silicone Sealant, or an approved equal that meets ASTM D5893. As directed by the engineer, the liquid seal material will be used to fill in any small voids along the preformed polychloroprene (neoprene) compression joint seal and vertical concrete faces. Spalls larger than 5/8" wide and 3" long shall be repaired with Delpatch Elastomeric Concrete, manufactured by the D.S. Brown Company, or an approved equal.
6. Any portion of the compression joint seal that is punctured, ruptured, or damaged in any other way shall be removed and replaced by the Contractor at no additional cost to the State.
7. All work shall be done in accordance with the NOTICE TO CONTRACTOR – WORK ON RAILROAD PROPERTY.

B. Inspection:

1. Stretching the seal during installation is the major cause of premature failure of the preformed polychloroprene (neoprene) compression joint seal.
2. Inspecting for stretch should be done very early in the sealing process. The inspection involves loosely laying a piece of preformed polychloroprene (neoprene) compression joint seal the entire width of the pavement and cutting it at the exact width of the pavement. The seal is then installed in the joint. Any excess amount of seal remaining at the end of the joint is due to stretch. The length of this excess is measured and a stretch percentage is calculated by dividing the excess length by the original length. Stretch greater than 2% is unacceptable. The depth of the seal shall be 0.125 inches (\pm .0625 inches) below the bottom of the chamfer. The seal shall not be twisted or have any deformity that interferes with the seal making complete contact with the joint face.

C. Manufacturers Technical Representative:

1. A manufacturer's technical representative of the preformed polychloroprene (neoprene) compression joint seal must be on site for the first two days during its installation to provide guidance to the Contractor in the proper installation procedures to the satisfaction of the Engineer.

END OF SECTION 07 91 15

SECTION 07 92 00 – JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Urethane joint sealants.
4. Latex joint sealants.

1.3 SUBMITTALS

- A. **Product Data:** For each joint-sealant product.
- B. **Samples for Verification:** For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- C. **Joint-Sealant Schedule:** Include the following information:
 1. Joint-sealant application, joint location, and designation.
 2. Joint-sealant manufacturer and product name.
 3. Joint-sealant formulation.
 4. Joint-sealant color.
- D. **Qualification Data:** For qualified testing agency.
- E. **Product Test Reports:** For each kind of joint sealant, for tests performed by a qualified testing agency.
- F. **Preconstruction Laboratory Test Schedule:** Include the following information for each joint sealant and substrate material to be tested:

1. Joint-sealant location and designation.
2. Manufacturer and product name.
3. Type of substrate material.
4. Proposed test.
5. Number of samples required.

G. **Preconstruction Laboratory Test Reports:** From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.

H. **Preconstruction Field-Adhesion-Test Reports:** Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

I. **Field-Adhesion-Test Reports:** For each sealant application tested.

J. **Sample Warranties:** For special warranties.

1.4 QUALITY ASSURANCE

A. **Installer Qualifications:** An authorized representative who is trained and approved by manufacturer.

B. **Product Testing:** Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

C. **Mockups:** Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.5 PRECONSTRUCTION TESTING

A. **Preconstruction Laboratory Testing:** Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Adhesion Testing: Use ASTM C 794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

2. Compatibility Testing: Use ASTM C 1087 to determine sealant compatibility when in contact with glazing and gasket materials.
3. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
6. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each kind of sealant and joint substrate.
3. Notify Architect (7) seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.6 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-

sealant manufacturer or are below 40 deg F.

2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle joint sealer materials as recommended by the Manufacturer, to protect from damage.

1.8 WARRANTY

- A. **Special Installer's Warranty:** Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: (2) Two years from date of Final Acceptance.

- B. **Special Manufacturer's Warranty:** Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: (5) Five years from date of Final Acceptance.

- C. **Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:**

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. **Compatibility:** Provide joint sealants, backings, and other related materials that are compatible

with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

- B. **VOC Content of Interior Sealants:** Sealants and sealant primers used inside the weatherproofing system shall comply with the following:
 - 1. Architectural sealants shall have a VOC content of 250 g/L or less.
 - 2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
 - 3. Sealants and sealant primers for nonporous substrates shall have a VOC content of 775 g/L or less.
- C. **Low-Emitting Interior Sealants:** Sealants and sealant primers shall comply with the testing and product requirements of the State of Connecticut
- D. **Colors of Exposed Joint Sealants:** As selected by Architect from manufacturer's full range.
- E. **Available Products:** Subject to compliance with requirements, products that may be incorporated into the Work include products of the following manufacturers:
 - 1. Tremco
 - 2. Dow Corning Corporation
 - 3. Pecora
 - 4. GE Silicon
 - 5. Or Approved Equal

2.2 SINGLE-PART URETHANE SEALANT (Sealant No. 1)

- A. **Polyurethane Sealant:** Single component, chemical curing, non-staining, non-bleeding, capable of continuous water immersion, non-sagging, self-leveling type; complying with Class A ASTM C 920, Type S, Grade NS, Class 25, Use NT, M, A, O.
- B. **Products:** Subject to compliance with requirements, provide the following:
 - 1. Low Modulus Expansion Joint Sealant: Dymonic, product of Tremco or Engineer's approved equal

2.3 SINGLE-PART SILICONE SEALANTS (Sealant No. 2)

- A. **Silicone Sealant:** Single component, neutral-cure, solvent curing, cold-applied, non-sagging, non-staining, fungus resistant, non-bleeding; complying with ASTM C 920, Type S, NS, Class 25.

B. **Products:** Subject to compliance with requirements, provide one of the following:

1. Silicone Sealant:
 - a. Dow 795 Silicone Building Sealant, product of Dow Corning Corporation.
 - b. Silpruf Silicone Sealant, product of GE Silicones.
 - c. Pecora 864 Silicone Sealant, product of Pecora.
 - d. Or Engineer's approved equal

2.4 ACRYLIC LATEX SEALANT (Sealant No. 3)

- A. **Sealant for interior joints, exposed or paint-finished:** Tremco Acrylic Latex sealant manufactured by the Tremco Manufacturing Company or Engineer's Approved Equal meeting the requirements of ASTM C-834.

2.5 JOINT-SEALANT BACKING

- A. **Sealant Backing Material, General:** Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. **Cylindrical Sealant Backings:** ASTM C 1330, Type C (closed-cell material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated], and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. **Bond-Breaker Tape:** Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

- A. **Primer:** Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. **Cleaners for Nonporous Surfaces:** Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. **Masking Tape:** Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. **Surface Cleaning of Joints:** Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish systems.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. **Joint Priming:** Prime joint substrates where recommended by joint-sealant manufacturer or as

indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

- C. **Masking Tape:** Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. **General:** Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. **Sealant Installation Standard:** Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. **Install sealants using proven techniques that comply with the following and at the same time backings are installed:**
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. **Tooling of Nonsag Sealants:** Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
4. Provide flush joint profile at locations indicated on Drawings according to Figure 8B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated on Drawings according to Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

A. **Field-Adhesion Testing:** Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
 - b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.
2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

- B. **Evaluation of Field-Adhesion-Test Results:** Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 SEALANT SCHEDULE

- A. **Interior and exterior joints requiring sealant work include, but are not limited to, the following:**
1. Metal/metal joints: Sealant No. 2.
 2. Masonry joints: Sealant No. 1.
 3. Concrete joints: Sealant No. 1.
 4. Glass/metal joints: Sealant No. 2.
 5. Metal/concrete: Sealant No. 1.
 6. Metal/wood joints: Sealant No. 3.

END OF SECTION 07 92 00

SECTION 07 92 05 - CONCRETE OVERLAY JOINT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This work shall consist of the following:

1. Creating transverse concrete overlay joints by sawing and sealing grooves in the finished surface of the concrete overlay and waterproofing top coat for the new railroad platform sections, at the dimensions and at the spacing and lines shown on the plans.
2. Creating longitudinal concrete overlay joints in the concrete overlay and waterproofing top coat for the new railroad platform sections -- adjacent to the proposed rubrail and edge plate -- by blocking out and sealing the overlay/waterproofing to the depth and width shown on the plans.
3. The overlay sawcut grooves and block outs shall be sealed with silicone joint sealant.

1.2 SUBMITTALS

A. A Materials Certificate for the silicone joint sealant shall be submitted by the Contractor in accordance with the requirements of CTDOT Form 816, Part 3 Section 1.06.07

PART 2 - PRODUCTS

2.1 MATERIALS

A. **Silicone Joint Seal:** Silicone joint sealant shall be one of the following or an approved equal:

1. Sealant, manufactured by the Dow Corning Corporation, Midland, Michigan Dow Corning 888 Silicone Joint Sealant, or
2. Dow Corning 888-SL Self-Leveling Silicone Joint 48686-0994

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS

A. **Sawing Transverse Grooves In Overlay/Waterproofing:**

1. Transverse concrete overlay joints shall be created by sawing grooves in the surface of the finished surface of the concrete overlay and waterproofing system of the new railroad

platform sections, of the dimensions and at the spacing and lines shown on the plans with an approved concrete saw.

2. After each joint is sawed, the saw cut and adjacent waterproofing system surface shall be thoroughly cleaned.
3. Sawing of the joints shall commence as soon as the waterproofing system and concrete overlay has hardened sufficiently to permit sawing without raveling, in accordance with the waterproofing and overlay manufacturers' instructions.
4. All transverse joints shall be sawed before uncontrolled shrinkage cracking takes place.
5. If necessary, the sawing operations shall be carried on both during the day and night, regardless of weather conditions, in accordance with the NOTICE TO CONTRACTOR – WORK ON RAILROAD PROPERTY.
6. The sawing of any joint shall be omitted if a crack occurs at or near the joint location prior to the time of sawing.
7. Sawing shall be discontinued when a crack develops ahead of the saw.
8. In general, all transverse joints shall be sawed in sequence.

B. Creating Longitudinal Block Outs In Overlay/Waterproofing:

1. The Contractor shall blockout the overlay/waterproofing to the depth and width shown on the plans, in order to delineate the locations to receive the silicone joint seal.
2. The block outs shall be thoroughly cleaned prior to joint sealant installation.

C. Sealing Joints:

1. Joints shall be sealed as soon after completion of the waterproofing/overlay curing period as feasible and before the platform is opened to pedestrian traffic, including the Contractor's equipment.
2. Just prior to sealing, each joint shall be thoroughly cleaned of all foreign material, and the joint-faces shall be clean and surface dry when the seal is applied.
3. The sealing material shall be applied to each joint opening to conform to the details shown on the plans or as directed by the Engineer.
4. Material for seal applied hot shall be stirred during heating so that localized overheating does not occur.
5. The pouring shall be done in such a manner that the material will not be spilled on the exposed surfaces of the waterproofing system, rub rail, and edge plate.
6. The use of sand or similar material as a cover for the seal will not be permitted.

7. Poured joint-sealing material shall not be placed when the air temperature in the shade is less than 50° F (10° C), unless approved by the Engineer.

END OF SECTION 07 92 05

SECTION 07 92 10 – FIXED PLATFORM JOINT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work under this item shall consist of furnishing and installing a fixed platform joint (FPJ) in conformance with ASTM D6297, as shown on the plans, and as specified herein.

1.2 SUBMITTALS

- A. A Materials Certificate for the leveling material, backer rod, and silicone joint sealant shall be submitted by the Contractor in accordance with the requirements of CTDOT Form 816, Part 3 Section 1.06.07

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The FPJ component materials shall conform to ASTM D6297 and the following:
 1. **Backer Rod:** All backer rods shall satisfy the requirements of ASTM D5249, Type 1.
 2. **Silicone Joint Seal:** Silicone joint sealant shall be one of the following or an approved equal:
 - a. Sealant, manufactured by the Dow Corning Corporation, Midland, Michigan Dow Corning 888 Silicone Joint Sealant, or
 - b. Dow Corning 888-SL Self-Leveling Silicone Joint 48686-0994
 3. **Concrete Leveling Material:** Shall be a cementitious-based material that conforms to ASTM C928 Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repair, for R3 performance requirements in Table 1 and achieve the following:
 - a. Final set in 45 Minutes
 - b. 2500 psi compressive strength in 24 hours
 - c. 5000 psi compressive strength in 7 days
 4. **Bridging Plate:** The bridging plates shall be steel conforming to the requirements of ASTM A36 and be a minimum 1/4" thick and 8" wide. For joint openings in excess of 3" the minimum plate dimensions shall be 3/8" thick by 12" wide. Individual sections of plate shall not exceed 4' in length. Steel locating pins for securing the plates shall be size 16d minimum, hot-dip galvanized, and spaced no more than 12" apart.

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS

- A. The FPJ shall be installed at the locations shown on the plans and in stages in accordance with the plans.
- B. At least 30 days prior to start of the work, the Contractor shall submit to the Department for approval a detailed Quality Control Plan for the installation of the FPJ. The submittal shall include:
 - 1. A list of all manufactured materials and their properties to be incorporated in the joint system, including, but not limited to the backer rod, silicone joint sealant, and leveling material.
 - 2. A detailed step by step installation procedure and a list of the specific equipment to be used for the installation. The Quality Control Plan must fully comply with the specifications and address all anticipated field conditions, including periods of inclement weather.
- C. The FPJ shall not be installed when the joint block out is wet.
- D. Concrete surfaces of the platform sections that will support the bridging plates shall be smooth and form a plane along and across the joint. Rough or damaged concrete surfaces shall be repaired with a leveling compound meeting the requirements of this specification. The existing and repaired concrete surfaces shall provide continuous uniform support for the bridging plate and prevent the plate from rocking and deflecting.
- E. The platform section fixed joint shall be thoroughly cleaned, sound, and dry just prior to receiving the backer rod and silicone joint sealant.
- F. A single backer rod, with a diameter at least 25% greater than the joint opening, shall be installed at an inch below the bridging plate in the platform section fixed joint opening between the concrete edges.
- G. The silicone joint sealant shall be applied to each joint opening to conform to the details shown on the plans or as directed by the Engineer.
- H. Material for seal applied hot shall be stirred during heating so that localized overheating does not occur.
- I. Poured joint-sealing material shall not be placed when the air temperature in the shade is less than 50° F (10° C), unless approved by the Engineer.
- J. Bridging plates shall be placed over the platform section joint opening. The plates shall be centered over the joint opening and secured with locating pins along its centerline. The plates shall be placed end to end, without overlap, such that the gap between plates does not exceed ¼". The plates shall extend between the rub rail and edge plate. Installed bridging plates shall not rock or deflect in any way.

- K. All work shall be done in accordance with the NOTICE TO CONTRACTOR – WORK ON RAILROAD PROPERTY.

END OF SECTION 07 92 10

SECTION 07 95 10 - LONGITUDINAL JOINT SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work under this item shall consist of furnishing and installing an elastomeric silicone expansion joint system as shown on the plans, as directed by the Engineer, and in accordance with these specifications.

1.2 SUBMITTALS

- A. A Materials Certificate will be required in accordance with CTDOT Form 816 Article 1.06.07 certifying the conformance of the elastomeric silicone expansion joint system components to the requirements set forth in this specification.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The following elastomeric silicone joint system manufacturers and their associated component materials have been approved for use:
 - 1. Silicon Specialists Corp.
P.O. Box 5009
Tulsa, OK 74150
Phone: (918) 587-5567
 - 2. TPS Expansion Joint System
Wabocrete II
Watson Bowman Acme
2-Part Silicone Sealant
 - 3. Watson Bowman & Acme Corp.
95 Pineview Drive
Amherst, NY 14120
Phone: (716) 691-7566
 - 4. XJS Expansion System
Silspec 900 PNS Nosing System
Dow Corning 902 RCS Silicone Sealant
- B. Each container of product furnished shall be delivered to the job site in the manufacturer's original sealed container. Each container shall be labeled to include the name of material, manufacturer's name, and the manufacturer's lot/batch number. All materials must be stored in

accordance with the manufacturer's written recommendations and as approved by the Engineer. Materials whose shelf life has expired shall not be used in the project.

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS

- A. A technical representative of the silicone expansion joint system approved by the manufacturer shall be present during the installation of the expansion joint to provide guidance to the Contractor in the proper installation procedures to the satisfaction of the Engineer.
- B. The silicone joint system shall be installed at the locations shown on the plans and in stages in accordance with the plans.
- C. Tools, equipment, and techniques used to prepare the joints shall be approved by the Engineer and the manufacturer's technical representative prior to the start of construction.
- D. Before installation of the silicone sealant, the vertical surfaces in the expansion joint opening to which the silicone sealant will bond shall be cleaned of a dust, dirt, debris and other loose materials as recommended by the manufacturer. Additionally, the bonding surfaces shall be blast cleaned if recommended by the manufacturer. Following blast cleaning when required, a backer rod of a diameter 25% larger than the joint opening shall be installed in the joint opening. The backer rod shall be comprised of closed-cell expanded polyethylene foam, compatible with cold applied seals unless otherwise approved by the manufacturer. The backer rod shall be installed to a clear depth of one inch (1") below the top surface of the waterproofing top coat as shown on the plans.
- E. Primer, if required by the manufacturer, shall be applied to the vertical surfaces of the overlay on which the silicone sealant will bond. The primer shall be allowed to cure undisturbed for a minimum of one hour prior to installation of the silicone adhesive, as required by the manufacturer and as directed by the Engineer.
- F. The mixing and installation of the two-part silicone sealant should be in strict conformance with the manufacturer's written recommendations. Pedestrian traffic or construction vehicles must not be allowed on the newly sealed joint for 60 minutes after sealant installation unless otherwise specified by the manufacturer.
- G. Any portion of the silicone expansion joint system that is punctured, ruptured, debonded, delaminated, or damaged in any other way shall be removed and replaced by the Contractor at no additional cost to the State.
- H. All work shall be done in accordance with the NOTICE TO CONTRACTOR – WORK ON RAILROAD PROPERTY.

END OF SECTION 07 95 10

SECTION 08 42 13 - ALUMINUM-FRAMED ENTRANCES

PART 1 - GENERAL

1.1 SUMMARY

A. **Section Includes:**

1. Exterior manual-swing entrance doors and door-frame units.
2. Sidelights.
3. Transoms.

1.2 RELATED SECTIONS

- A. 08 80 00 – Glazing

1.3 SUBMITTALS

A. **Product Data:** For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. **Shop Drawings:** For aluminum-framed entrances. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

- C. **Samples for Verification:** For each type of exposed finish required, in manufacturer's standard sizes.
- D. **Entrance Door Hardware Schedule:** Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
- E. **Qualification Data:** For Installer and field testing agency.
- F. **Energy Performance Certificates:** For aluminum-framed entrances, accessories, and components, from manufacturer.
 - 1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance.
- G. **Product Test Reports:** For aluminum-framed entrances.
- H. Field quality-control reports.
- I. **Sample Warranties:** For special warranties.
- J. **Maintenance Data:** For aluminum-framed entrances to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. **Installer Qualifications:** An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. **Testing Agency Qualifications:** Qualified according to ASTM E 699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials as recommended by the Manufacturer, to protect from damage.

1.6 WARRANTY

- A. **Special Warranty:** Manufacturer agrees to repair or replace components of aluminum-framed entrances that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. **Special Finish Warranty:** Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within

specified warranty period.

1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. **General Performance:** Comply with performance requirements specified, as determined by testing of aluminum-framed entrances representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. **Structural Loads:**
 1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: As indicated on Drawings
- C. **Structural:** Test according to ASTM E 330 as follows:
 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- D. **Air Infiltration:** Test according to ASTM E 283 for infiltration as follows:
 1. Entrance Doors:
 - a. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
- E. **Water Penetration under Static Pressure:** Test according to ASTM E 331 as follows:
 1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

- F. **Energy Performance:** Certify and label energy performance according to NFRC as follows:
1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.35 as determined according to NFRC 200.
 3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 45 as determined according to NFRC 500.
- G. **Noise Reduction:** Test according to ASTM E 90, with ratings determined by ASTM E 1332, as follows.
1. Outdoor-Indoor Transmission Class: Minimum 26
- H. **Thermal Movements:** Allow for thermal movements resulting from ambient and surface temperature changes:
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 MANUFACTURERS

- A. Thomas Manufacturing Inc.
- B. Kawneer North America; an Alcoa company.
- C. YKK AP America Inc.
- D. Or approved equal

2.3 ENTRANCE DOOR SYSTEMS

- A. **Entrance Doors:** Manufacturer's standard glazed entrance doors for manual-swing operation.
1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 2. Door Design: Match existing.
 3. Glazing Stops and Gaskets: match existing, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.
- B. **Framing Members:** Manufacturer's standard extruded aluminum, minimum 0.125 inch thick and reinforced as required to support imposed loads.

1. Nominal Size: 1-3/4 by 4-1/2 inches.
- C. **Backer Plates:** Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- D. **Brackets and Reinforcements:** Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- E. **Materials:**
 1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209.
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
 - d. Structural Profiles: ASTM B 308/B 308M.
 2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
 - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 ENTRANCE DOOR HARDWARE

- A. **General:** Provide entrance door hardware for each entrance door to comply with requirements in this Section.
 1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products complying with BHMA standard referenced.
 2. Opening-Force Requirements:
 - a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion and not more than 15 lbf to open the door to its minimum required width.
 - b. Accessible Interior Doors: Not more than 5 lbf to fully open door.
- B. **Designations:** Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware

Sets" Article. Products are identified by using entrance door hardware designations as follows:

1. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.
 - C. **Continuous-Gear Hinges:** Manufacturer's standard with stainless-steel bearings between knuckles, fabricated to full height of door and frame.
 - D. **Mortise Auxiliary Locks:** BHMA A156.5, Grade 1.
 - E. **Cylinders:** BHMA A156.5, Grade 1.
 1. Keying: Master key system. Permanently inscribe each key with a visual key control number and include notation to be furnished by Owner.
 - F. **Strikes:** Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
 - G. **Operating Trim:** BHMA A156.6.
 - H. **Closers:** BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.
 - I. **Door Stops:** BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.
 - J. **Weather Stripping:** Manufacturer's standard replaceable components.
 1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
 - K. **Weather Sweeps:** Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
 - L. **Silencers:** BHMA A156.16, Grade 1.
 - M. **Thresholds:** BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.
- 2.5 GLAZING
- A. **Glazing:** Comply with Section 08 80 00 "Glazing."
 - B. **Glazing Gaskets:** Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
 - C. **Glazing Sealants:** As recommended by manufacturer.

2.6 ACCESSORIES

- A. **Fasteners and Accessories:** Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- B. **Anchors:** Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- C. **Concealed Flashing:** Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- D. **Bituminous Paint:** Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.7 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. **Entrance Door Frames:** Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.
- E. **Entrance Doors:** Reinforce doors as required for installing entrance door hardware.
 1. At exterior doors, provide weather sweeps applied to door bottoms.
- F. **Entrance Door Hardware Installation:** Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

- A. **Color Anodic Finish:** AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 1. Color: Match existing

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. **General:**
 1. Comply with manufacturer's written instructions.
 2. Do not install damaged components.
 3. Fit joints to produce hairline joints free of burrs and distortion.
 4. Rigidly secure nonmovement joints.
 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 6. Seal perimeter and other joints watertight unless otherwise indicated.
- B. **Metal Protection:**

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or installing nonconductive spacers.
 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Set continuous sill members and flashing in full sealant bed as specified by Aluminum-Framed Entrance manufacturer to produce weathertight installation.
- D. Install components plumb and true in alignment with established lines and grades.
- E. Install glazing as specified in Section 088000 "Glazing."
- F. **Entrance Doors:** Install doors to produce smooth operation and tight fit at contact points.
1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.3 FIELD QUALITY CONTROL

- A. **Testing Agency:** Engage a qualified testing agency to perform tests and inspections.
- B. **Field Quality-Control Testing:** Perform the following test on aluminum-framed entrances.
1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
- C. Aluminum-framed entrances will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.4 MAINTENANCE SERVICE

- A. **Entrance Door Hardware:**
1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.

3.5 ENTRANCE DOOR HARDWARE SETS

A. To be determined

END OF SECTION 08 42 13

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Glass for aluminum framed entrances.
2. Glazing sealants and accessories.
3. Vandal Film

1.2 RELATED SECTIONS

- ##### A. Section 08 42 13 – Aluminum Framed Entrances

1.3 DEFINITIONS

- ##### A. **Glass Manufacturers:** Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- ##### B. **Glass Thicknesses:** Indicated by thickness designations in millimeters according to ASTM C 1036.
- ##### C. **IBC:** International Building Code.
- ##### D. **Interspace:** Space between lites of an insulating-glass unit.

1.4 COORDINATION

- ##### A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 ACTION SUBMITTALS

- ##### A. **Product Data:** For each type of product.
- ##### B. **Glass Samples:** For each type of the following products; 12 inches square.
1. Laminated, insulating glass.
- ##### C. **Glazing Accessory Samples:** For sealants and colored spacers, in 12-inch lengths. Install

sealant samples between two strips of material representative in color of the adjoining framing system.

- D. **Glazing Schedule:** List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- E. **Qualification Data:** For Installer, manufacturers of insulating-glass units with sputter-coated, low-E coatings, glass testing agency and sealant testing agency.
- F. **Product Certificates:** For glass.
- G. **Product Test Reports:** For insulating glass and glazing sealants, for tests performed by a qualified testing agency.
 - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- H. Preconstruction adhesion and compatibility test report.
- I. **Sample Warranties:** For special warranties.

1.6 QUALITY ASSURANCE

- A. **Installer Qualifications:** A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- B. **Glass Testing Agency Qualifications:** A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- C. **Sealant Testing Agency Qualifications:** An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 - 2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - 3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 - 4. Schedule enough time for testing and analyzing results to prevent delaying the Work.

5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.9 FIELD CONDITIONS

- A. **Environmental Limitations:** Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.10 WARRANTY

- A. **Manufacturer's Special Warranty for Laminated Insulated Glass:**
 1. Manufacturer agrees to replace laminated-insulated glass units that deteriorate within specified warranty period.
 - a. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - b. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Old Castle

2. PPG Industries
 3. Pilkington Glass
 4. Or Approved Equal
- B. **Source Limitations for Glass:** Obtain from single source from single manufacturer for each glass type.
- C. **Source Limitations for Glazing Accessories:** Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

- A. **General:** Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. **Delegated Design:** Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- C. **Structural Performance:** Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
1. **Design Wind Pressures:** Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
 - a. **Basic Wind Speed:** As indicated on Drawings.
 - b. **Importance Factor:** As indicated on Drawings.
 - c. **Exposure Category:** AS indicated on drawings
 2. **Maximum Lateral Deflection:** For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
- D. **Safety Glazing:** Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- E. **Thermal and Optical Performance Properties:** Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 2. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's

WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.

3. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
4. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

- A. **Glazing Publications:** Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
 2. IGMMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. **Insulating-Glass Certification Program:** Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- C. **Thickness:** Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

2.4 GLASS PRODUCTS

- A. **Fully Tempered Float Glass:** ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear).

2.5 LAMINATED GLASS

- A. **Laminated Glass:** ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
 1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 3. Interlayer Color: Clear unless otherwise indicated.

2.6 INSULATING GLASS

- A. **Insulating-Glass Units:** Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Perimeter Spacer: Manufacturer's standard spacer material and construction
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.7 GLAZING SEALANTS

A. **General:**

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. **Glazing Sealant:** Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation; 790.
 - b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
 - c. May National Associates, Inc.; Bondaflex Sil 290.
 - d. Pecora Corporation; 890.
 - e. Sika Corporation, Construction Products Division; SikaSil-C990.
 - f. Tremco Incorporated; Spectrem 1.
 - g. Or Engineer's Approved Equal

2.8 GLAZING TAPES

A. **Back-Bedding Mastic Glazing Tapes:** Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. **Expanded Cellular Glazing Tapes:** Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.9 MISCELLANEOUS GLAZING MATERIALS

- A. **General:** Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. **Cleaners, Primers, and Sealers:** Types recommended by sealant or gasket manufacturer.
- C. **Setting Blocks:** Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. **Spacers:** Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. **Edge Blocks:** Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. **Cylindrical Glazing Sealant Backing:** ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.10 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.11 VANDAL FILM

- A. **Manufacturers:**

1. GPFilms Inc., 575 Maryville Centre, Drive. St. Louis, MO 63141; 800-851-7781; www.llumar.com.
 2. Graffiti Removal Inc., PO Box 2991, La Habra, CA 90632; 909-464-2700; www.vandalshield.com
 3. Madico Inc, 65 Industrial Pky, Woburn, MA 01801; 800-225-1926; www.madico.com
 4. Or engineer's approved equal
- B. **Product Description:** Multi-layered product, 7 mils thick, applied to glass surfaces, from outboard surface to inboard surface:
1. Removable release liner.
 2. Pressure sensitive adhesive.
 3. Clear, dyed or metalized layers of polyester film.
 4. Scratch resistant coating.
- C. **Colors:** Clear.
- D. **Glazing Film Accessories:**
1. General: Provide products complying with requirements of glazing film manufacturer for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
 2. Adhesive: Pressure sensitive acrylic adhesive system.
 3. Cleaners, Primers, and Sealers: Types recommended by glazing film manufacturer.
- E. **Location:** Window film is required to be installed at all locations accessible to the public throughout the area of work. Window film is to be installed to a minimum height of 7'-0" above any accessible walking surface. Any glazed window that receives the scratch resistant film shall be covered in its entirety. Refer to Quality Assurance within this section for additional requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.

2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Window Film:

1. Examine glass and surrounding adjacent surfaces for conditions affecting installation.
 - a. Report conditions that may adversely affect installation. In report, include description of any glass that is broken, chipped, cracked, abraded, or damaged in any way.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Beginning of installation means acceptance of conditions

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. **Window film:**
1. Comply with manufacturer's written instructions for surface preparation.
 2. Immediately before beginning installation of films, clean glass surfaces of substances that could impair glazing film's bond, including mold, mildew, oil grease, dirt, and other foreign materials.
 3. Protect window frames and surrounding conditions from damage during installation.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.5 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.6 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.7 INSULATING-LAMINATED-GLASS

- A. **Glass Type:** Clear insulating laminated glass.
 - 1. Overall Unit Thickness: 1 inch
 - 2. Minimum Thickness of Outdoor Lite: 6 mm
 - 3. Outdoor Lite: Fully tempered float glass.
 - 4. Interspace Content: Air.
 - 5. Indoor Lite: Clear laminated glass with two plies of fully tempered float glass.
 - a. Minimum Thickness of Each Glass Ply: 6 mm
 - 6. Winter Nighttime U-Factor: 0.80 maximum.
 - 7. Summer Daytime U-Factor: 0.80 maximum.

8. Solar Heat Gain Coefficient: 0.40 maximum.
9. Safety glazing required.

END OF SECTION 08 80 00

SECTION 09 61 40 - DETECTABLE / TACTILE WARNING SURFACES

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall provide all labor, materials, equipment and services necessary for and incidental to, furnishing and installing cast-in-place tactile warning surface as shown on the drawings and as specified herein.
- B. This Section specifies furnishing and installing a two-part cast-in-place in-line dome tactile warning surface on new concrete platforms, as indicated on the Drawings. The Work also includes required coordination of the Work with work of other Sections, surface/substrate preparations, and tactile warning system installations, and includes coordination with and transitions to adjacent systems and surfaces, complete. The Work also includes such related and accessory work as may be required for the successful completion of the Work of this Section.
- C. Related Documents
 - 1. Drawings and general provisions of the Contract, including General and Special Provisions, apply to this Section.
- D. Correlation of Contract Documents
 - 1. Refer to General and Special Provisions for additional requirements affecting the interpretation of Drawings and Specifications and affecting the Work of this Section.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's literature describing products, installation procedures and routine maintenance, including appropriate Material Safety Data Sheets (MSDS).
- B. Samples for Verification Purposes: Submit three (3) samples of full size cast-in-place in-line dome tactile warning surface, of the kind proposed for use, with all installation accessories required for the project.
- C. Shop drawings are required for products specified showing fabrication details; panel surface profile; composite structural system; plans of panel placement including joints; and material to be used as well as outlining installation materials and procedure.
- D. Material Test Reports: Submit test reports from qualified independent testing laboratory indicating that materials proposed for use are in compliance with requirements and meet the properties indicated. All test reports shall be conducted on a cast-in-place tactile panel system as certified by a qualified independent testing laboratory.
- E. Maintenance Instructions: Submit copies of manufacturer's specified maintenance practices for each type of tactile panel and accessory as required.

1.3 QUALITY ASSURANCE

- A. Provide cast-in-place in-line dome tactile panels and accessories as produced by a single manufacturer.
- B. Installer's Qualifications: Engage an experienced Installer trained and certified in writing by tactile surface manufacturer as qualified for installation, who has successfully completed installations similar in material, design, and extent to that indicated for Project. Manufacturer's supervisor shall be present at all times.
- C. Americans with Disabilities Act (ADA): Provide tactile warning surfaces which comply with the detectable warnings on walking surfaces and platform edge detectable warnings, section of the Americans with Disabilities Act, latest version.
- D. All applicable building codes, latest versions.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the job site in sealed, undamaged containers with labels intact and legible, indicating the material name, date of manufacture and lot number.
- B. Store materials in a dry location at temperatures not exceeding 90° F, or lower than 35° F.

1.5 SITE CONDITIONS

- A. Environmental Conditions and Protection: Maintain minimum temperature prior to installations, during installation, and after completion of installation in strict compliance with the manufacturer's written instructions.
 - 1. All materials individually or mixed shall have zero volatile organic content.
 - 2. Do not apply materials if rain is anticipated within three hours of application.
 - 3. Substrate and air temperature must remain above 40° F for at least 4 hours after application of materials and remain above freezing for 24 hours.
 - 4. All materials are non-hazardous and Class A fire-rated.
- B. Install materials in accordance with all safety and weather conditions required by manufacturer or as modified by applicable rules and regulations of local, state and federal authorities having jurisdiction.
- C. The use of water for work, cleaning or dust control, etc. shall be contained and controlled and shall not be allowed to come into contact with the passengers or public. Provide barricades or screens to protect passengers or public.
- D. Disposal of any liquids or other materials of possible contamination shall be made in accordance with federal state and local laws and ordinances.
- E. Cleaning materials shall have code acceptable low VOC solvent content and low flammability if used on the site.

- F. Coordinate phasing and flagging personnel operations as specified elsewhere.

1.6 GUARANTEE

- A. The certified applicator and the manufacturer shall provide the Owner with a five (5) year joint guarantee on the products, specification and installation

1.7 MAINTENANCE

- A. Wash with soap and water with a bristle brush or pressure washer of 1000 psi.
- B. Chemical spills should be removed to avoid possible damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Project standard of quality for the Cast-in Place Tactile Warning Surface materials, chemical composition, fabrication, appearance, color, performance, installation and warranty is based on: Strongwarn SWADA-1000/2000, Detectable Warning Surfaces, manufactured by Strongwall Industries Inc., 107 Chestnut Street, Ridgewood, New Jersey 07450, (201-445-4633). Existing engineered ADA and field tested products which are subject to compliance with requirements, may be incorporated in the work and shall meet or exceed the specified test criteria and characteristics.
 - 1. Color: Canary Yellow conforming to Owners standards. Sample of colors shall be submitted to Owner and the Engineer for review.
- B. Alternate product: Provide CRYL-A-FLEX TWS Tactile Warning Strip, as manufactured by DUR-A-FLEX, Inc., 95 Goodwin Street, East Hartford, Ct. 06108 (800-253-3539).
- C. Or approved equal.

2.2 MATERIALS

- A. #82 Truncated Dome: A blend of carboxylated latex emulsion with a factory apportioned powder catalyst. #82 is injected, or hand applied, onto the mold array, to form the required tactile warning surface.
- B. One 5 gallon pail #82 liquid and eight 32.5lb bags of #82 powder form one unit. Average yield, Domes: SWADA-1000/2000- 400 square feet per unit.
 - 1. Mixing Ratio: 5.5 quarts (maximum) of #82 latex emulsion and two 32.5 lb bags of #82 catalyst powder. Micro-adjust in the field, for the quantity of liquid used, to achieve optimum handling.
- C. #32 Field: A two-component blend of latex vinyl copolymer with a factory apportioned catalyst powder and pigments, which is used to form the required field.
 - 1. Mixing Ratio: One 5-gallon pail of #32 Emulsion and two 55-lb bags of #32 Catalyst Powder form one unit.

2. Average Yield: 400 square feet of field. One coat at 30 mils wet.

- D. #4 Pigmented Sealer: Used to enhance color quality, it is applied directly from the container. #4 will yield 700 square feet per 5-gallon pail. Stir for 30 seconds and apply with a long nap roller or brush. Apply in two coats

2.3 SUPPLEMENTAL MATERIALS

- A. EM-100-N Crack Treatment Component: Elastomeric rubber emulsion.
- B. Strongcrete SW-81: SBR modified structural repair mortar material.
- C. Cleaning agent: Water

2.4 EQUIPMENT

- A. Flexible and reusable molds
- B. Strongwarn material injector

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Concrete:
 - 1. Inspect the top surface of the substrate. Perform all necessary substrate repairs and remove laitance, grease, oil, paint and other contaminants, which will affect system adhesion.
 - 2. Commencement of system installation only implies the acceptance of the top surface, as suitable to accept the system.

3.2 PREPARATION

- A. Equipment options:
 - 1. Shotblast or scarify, and vacuum so that the surface is clean, then water blast machine capable of delivering a minimum water pressure of 4000 psi to the substrate.
- B. Procedure
 - 1. Make as many passes as required with shotblast or scarifying machine and vacuum surface clean.
 - 2. Pretreat areas of oil drippings with a penetrating oil remover and rinse. Spray concrete deck with HD cleaner, allow to soak for 30 minutes without drying, and water blast with 4000 psi.

3.3 APPLICATION

- A. #82 Truncated domes:

1. Mixing:

- a. Place #82 Emulsion in an appropriate size container. Add the appropriate amount of #82 Catalyst Powder, while mixing continuously with a paddle mixer and a heavy duty slow speed (400-600 rpm) drill. Continue mixing until uniform mixture consistency is achieved, but, do not mix for more than 2 minutes. Mixture working time is 20 minutes at 70°F.

2. Placement:

- a. With clean water, dampen concrete and all porous substrate surfaces to a dull finish. Immediately place mold segments onto the work area.
- b. Place #82 mixture onto the molds using a squeegee and a trowel, to help work the material into the mold openings and remove excess material from exposed surfaces of the molds.
- c. Caution: Do not touch or move the mold, since it may break the bond.
- d. #82 mixture must be cured sufficiently to resist pressure with index finger before mold segments can be removed without causing damage.

3. Minimum Curing Time:

- a. 45°F - 55°F allow to cure for 12 hours minimum.
- b. 55°F - 70°F allow to cure for 6 hours minimum.
- c. Above 70°F allow to cure for 3 hours minimum.
- d. Do not apply at temperatures below 45°F

B. #32 Field: (two coats required)

1. Mixing:

- a. Stir #32 Emulsion for about 30 seconds using a heavy-duty drill and a Jiffy blade.
- b. Pour #32 Emulsion into a clean container. Gradually add #32 Catalyst Powder, mixing continuously as the powder is added. Never reverse this procedure.
- c. After all powder has been added, continue mixing for a minimum of three minutes until the materials form a lump-free mixture. The pot life at 70°F is approximately 25 minutes. Do not attempt to remix or use any material that has begun to set.

2. Application:

- a. With clean water, dampen concrete and all porous surfaces to a dull finish.
- b. Apply mixture with a long nap roller and allow to cure for one hour (minimum) at 70°F prior to application of additional coats.

C. #4 Sealer (two coats required)

1. Stir material for 20 seconds using a heavy drill and a Jiffy blade.

2. Apply to a dry #32 surface with a long nap roller. Allow to cure for one hour (minimum) at 70°F prior to application of additional coats.

3. Allow to cure overnight before accepting traffic.

3.4 INSTALLATION

- A. During all procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.
- B. The specifications of the tactile warning surface and related materials shall be in strict accordance with the contract documents and the guidelines set by their respective manufacturers.
- C. Prior to placement of the Cast-in-place system, the manufacturer's shop drawings shall be reviewed and a layout drawing prepared by the installation Design-Builder to resolve the issues related to pattern repeat, tile cuts, expansion joints, control joints, platform curves, platform end returns and platform surface interferences.
- D. During and after the warning surface installation and the curing stage, it is imperative that there is no walking, leaning or external forces placed on the warning surface. The Design-Builder shall provide adequate protection of the work areas completed.

3.5 CLEANING AND PROTECTING

- A. Protect warning surface against damage during construction period to comply with tactile warning surface manufacturer's specification.
- B. Protect warning surface against damage from rolling loads following installation by covering with plywood or hardwood.
- C. Clean tactile warning surface not more than four days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project. Clean tactile warning surface by method specified by manufacturer.

3.6 DEMONSTRATION / TRAINING

- A. Instruct Owner's personnel in proper use, operations, and maintenance of tactile warning surfaces. Review and instruct Owner's selected personnel in the use of all necessary equipment to properly install or repair tactile warning surfaces. Train Owner's personnel in procedures to follow in identifying sources of installation failures and emergencies associated with the improper use, storage or handling of all materials.

END OF SECTION 09 61 40

SECTION 09 67 10 – RAILROAD PLATFORM WATERPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work under this item consists of all work shown on the plans to prepare the surfaces of, and apply a waterproofing system to, the proposed microsilica concrete overlay of the new eastbound and westbound platform sections -- full length and full width. Also included is the application of "Watch the Gap" signage on the new platform surfaces (near the track-side edges) at the locations shown on the plans.
- B. The work under this item also includes all work shown on the plans to mill and apply a waterproofing system to the existing platform landing area surfaces identified on the plans.
- C. The waterproofing system shall be a spray applied, fast cure, high-build polymer system with a broadcast aggregate for skid resistance and a top sealer coat. The "Watch the Gap" signage on the platforms shall consist of a compatible skid resistant colored coating.
- D. The color and texture of the waterproofing system and signage products shall be as approved by the Engineer. The "Watch the Gap" signage shall consist of black lettering on a rectangular high visibility yellow background. The products shall be applied to the prepared platform areas as defined in the plans in strict accordance with the Manufacturer's recommendations.

1.2 SUBMITTALS

- A. The contractor shall submit proposed product data sheets for the waterproofing system and the signage skid resistant system, surface preparation procedures, installation procedures, two sample coupons (4"x4") that are representative of the finished surface, texture and colors, and Material Safety Data Sheets for approval.
- B. Copies of the Material Safety Data Sheets for all products used shall be kept on site and made available to personnel performing the work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The waterproofing system shall be the following or an approved equal:
 - 1. Top Coat
 Manufacturer: Bridge Preservation, LLC
 686 S. Adams St.
 Kansas City, KS 66105
 Tel: 913-321-9000

B. Provide a waterproofing system that meets or achieves all of the following requirements:

1. For the Multi-Component Polymer Primer:
 - a. Gel Time > 5 minutes
 - b. Tack Free Time < 2.5 hours at 77°F or below
 - c. Adhesion to Concrete > 150 psi (per ASTM D 4541)
2. For the Base Coat of Spray Applied Waterproofing Membrane, Rapid Curing Elastomer:
 - a. Gel Time < 10 seconds
 - b. Cure Time < 30 seconds
 - c. Tack Free Time < 30 minutes
 - d. Shore Hardness > 40D per ASTM D 2240
 - e. Adhesion to Concrete > 150 psi per ASTM D 4541
 - f. Tensile Strength > 2,000 psi per ASTM D 638
 - g. Elongation at Break > 150% per ASTM D 638
 - h. Crack Bridging Ability Pass at 40 Cycles per ASTM C 836
 - i. The surface thickness that is applied on the platforms shall be at least the same thickness as that used for the tests above.
3. For the Spray Applied Aggregate Membrane, Rapid Curing Elastomer:
 - a. Open to Light Traffic 1 Hour
 - b. Gel Time > 30 seconds
 - c. Tack Free Time > 5 minutes
 - d. Tensile Strength > 2,000 psi per ASTM D 638
 - e. Elongation at Break > 150% per ASTM D 638
 - f. Crack Bridging Ability Pass at 40 Cycles per ASTM C 836
 - g. The surface thickness that is applied on the platforms shall be at least the same thickness as that used for the tests above.
4. Broadcast aggregate shall consist of clean, hard (Moh's hardness range 6 to 7), dry, rounded, non-angular aggregate meeting the following gradation:

Fine Mesh Aggregate					
Fine Mesh	#10	#16	#20	#30	#50
% Passing	98-100	30-45	8-18	2-10	0-2

5. For the Aliphatic Coating Top Coat:
 - a. Gel Time > 20 minutes
 - b. Tack Free Time 1 hour
 - c. Shore Hardness 60-65 D per ASTM D 2240
 - d. Tensile Strength 3,500 – 4,500 psi per ASTM D 638
 - e. Elongation 2.5 – 5 % per ASTM D 638
 - f. Taber Abrasion 39 mg loss per ASTM D 4060

C. The “Watch the Gap” signage skid resistant system shall be compatible with the railroad platform waterproofing system previously applied and consist of a colored aliphatic coating with the properties listed above and the colors listed below. Broadcast aggregate shall be included in the signage.

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS

- A. The contractor shall provide the services of a technical representative of the manufacturer. This representative shall be on the project site at the start of the waterproofing-related work and remain until released by the Engineer. The representative shall provide advice on prepping, mixing, and placing the waterproofing system products and the “Watch the Gap” signage. The technical representative, upon consultation with the Engineer, may suspend any item of work that is suspect and does not meet the requirements of this specification. Resumption of work will occur only after the manufacturer’s representative and the Engineer are satisfied that appropriate remedial action has been taken by the contractor.
- B. The contractor shall submit for review a detailed, written sequence and procedure for performing the waterproofing-related work in accordance with the plans and the NOTICE TO CONTRACTOR - WORK ON RAILROAD PROPERTY.
- C. The application of the waterproofing system to the new platform sections shall be accomplished in uninterrupted sections between platform “expansion joints” in accordance with the plans and the NOTICE TO CONTRACTOR - WORK ON RAILROAD PROPERTY.
- D. The application of the waterproofing system to the new platform sections shall be done before both the “tactile warning strips” and the platform “concrete overlay joints” are installed.
- E. Application of the waterproofing system to the new platforms shall take place immediately after the microsilica overlay surface has been prepared, i.e. made free of oil, grease, curing compounds, loose particles, moss, algae growth, laitance, friable matter, dirt, and bituminous products; and prior to any public access being granted to that portion of platform.
- F. Application of the waterproofing system to the existing platform landing areas indicated on the plans shall take place immediately after the existing surface is milled, shotblasted, or ground and prior to any public access being granted to that landing area. Surfaces shall be free of oil, grease, curing compounds, loose particles, moss, algae growth, laitance, friable matter, dirt, bituminous products and previous waterproofing materials. Shotblasting, grinding, or milling shall be used to provide a sound substrate free from laitance. The surface profile is not to exceed 1/8” (3 mm) (peak to valley).
- G. If required, degreasing of surfaces to receive the waterproofing system shall be performed via detergent washing in accordance with ASTM D4258.
- H. All waterproofing system related work, including shotblasting, grinding, and milling operations for the platform landing areas shall cease prior to a train entering the station on an adjacent track, to prevent damage to the train and injury to commuters. Sufficient distance between the surface preparation process and waterproofing system application shall be provided to prevent any injury or discomfort to commuters on the platform or train. Vacuum shotblasting is anticipated as a means to minimize the spread of debris.
- I. Remove excess loose aggregate prior to applying the final top binder surface. Apply an aliphatic coating for the top binder surface, or an approved equal, to lock the aggregate into place. The

material type and cure time shall be chosen so as to meet the maximum closure windows required by the plans and the NOTICE TO CONTRACTOR - WORK ON RAILROAD PROPERTY.

- J. The "Watch the Gap" signage shall be installed in the specified areas after the new waterproofing system has cured. Before applying the signage, the area shall be clean and free of any contamination. One coat of an approved high visibility yellow color shall be installed in a rectangle shape at a minimum thickness of 50 mils. Once cured a second coat of an approved black color shall be used to stencil "Watch the Gap" centered properly over the first rectangular coat at a minimum 50 mils. Both coats shall be applied in accordance with manufacturer's recommendations to provide a neat finish and edges. Do not feather edge.
- K. If an area is left untreated or the binder becomes damaged, a patch repair shall be carried out to restore the integrity of the system. The damaged area shall be cut back to sound material and wiped with solvent (e.g. acetone) up to a width of at least 4" on the periphery. The area shall then be repaired using the same procedures and steps to restore a uniform, continuous appearance. One coat of sealer shall be applied with a 4" minimum overlap onto the existing area.

END OF SECTION 09 67 10

SECTION 10 14 00 – IDENTIFYING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. **Section Includes:**

1. Panel signs

1.2 DEFINITIONS

- A. **Accessible:** In accordance with the accessibility standard.

1.3 SUBMITTALS

- A. **Product Data:** For each type of product.

- B. **Shop Drawings:** For panel signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.

- C. **Product Schedule:** For panel signs. Use same designations indicated on Drawings or specified.

- D. **Qualification Data:** For Installer and manufacturer.

- E. **Sample Warranty:** For special warranty.

- F. **Maintenance Data:** For signs to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. **Installer Qualifications:** An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials as recommended by the Manufacturer, to protect from

damage.

1.6 WARRANTY

- A. **Special Warranty:** Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image.
 - c. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. **Thermal Movements:** For exterior signs, allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F ambient; 180 deg F, material surfaces.
- B. **Accessibility Standard:** Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design and ICC A117.1.

2.2 PANEL SIGNS

- A. **Panel Sign:** Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
 - 1. Solid-Sheet Sign: Aluminum sheet with finish specified in "Surface Finish and Applied Graphics" Subparagraph and as follows:
 - a. Thickness: Manufacturer's standard for size of sign
 - b. Surface-Applied, Flat Graphics: Applied vinyl film.
 - 2. Sign-Panel Perimeter: Finish edges smooth.
 - a. Edge Condition: As indicated on Drawings
 - b. Corner Condition in Elevation: As indicated on Drawings

3. Mounting: As indicated on Drawings.
4. Surface Finish and Applied Graphics:
 - a. Integral Aluminum Finish: Clear anodized
5. Text and Typeface: typeface as selected by Architect from manufacturer's full range

2.3 PANEL-SIGN MATERIALS

- A. **Aluminum Sheet and Plate:** ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- B. **Vinyl Film:** UV-resistant vinyl film of nominal thickness indicated, with pressure-sensitive, permanent adhesive on back; die cut to form characters or images as indicated on Drawings and suitable for exterior applications.

2.4 ACCESSORIES

- A. **Fasteners and Anchors:** Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following unless otherwise indicated:
 1. Use concealed fasteners and anchors unless indicated to be exposed.
 2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
 3. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
 - b. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant Allen-head, or spanner-head slots unless otherwise indicated.
 4. Sign Mounting Fasteners:
 - a. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.
- B. **Bituminous Paint:** Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.5 FABRICATION

- A. **General:** Provide manufacturer's standard sign assemblies according to requirements indicated.
 1. Preassemble signs in the shop to greatest extent possible. Disassemble signs and

assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.

2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
 4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 5. Internally brace signs for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
 6. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- B. **Shop-Applied Vinyl:** Align vinyl film in final position and apply to surface. Firmly press film from the middle outward to obtain good bond without blisters or fishmouths.

2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. **Appearance of Finished Work:** Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. **Directional Finishes:** Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. **Organic, Anodic, and Chemically Produced Finishes:** Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.7 ALUMINUM FINISHES

- A. **Clear Anodic Finish:** AAMA 611, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. **General:** Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 - 4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. **Accessible Signage:** Install in locations on walls as indicated on Drawings and according to the accessibility standard.
- C. **Mounting Methods:**
 - 1. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 00

SECTION 12 93 40 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

A. **Work of this section includes:**

1. Recycling Centers, in the color and finish selected by Metro-North, and in the length and quality shown indicated on contract drawings and herein. Install
2. Anchoring requirements for reinstallation of salvaged benches

1.2 REFERENCES

- A. American Institute of Steel Construction (ASIC) - Applicable standards.
- B. AWS D1.1 Structural Welding Code
- C. Industrial Fasteners Institute (IFI) Fastener Standard Book
- D. American Society of Testing Materials.

1.3 SUBMITTALS

- A. Submit samples of all materials and products for approval.
- B. **Submit shop drawings showing the following:**
 1. Types of materials, including sizes and weights of members.
 2. Location, types and details of connections.
- C. **Product data:** For each type of product
- D. Submit manufacturers' literature for all accessories including but not limited to fasteners, bolts and weld rods.
- E. **Warranty:** Manufacturer's standard warranty.
- F. **Maintenance data:** for site furnishings to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. **Installer Qualifications:** Installer of site furnishings is a certified installer with documented

history installing manufacturer's products according to manufacturer's specifications.

1.5 PRODUCT HANDLING

- A. The Contractor shall be responsible for replacing all materials damaged up until the time of completion and final acceptance of the work of this section.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials as recommended by the Manufacturer, to protect from damage.

1.7 WARRANTY

- A. Manufacturer to warrant its products to be free from material defects and/or workmanship for a period of three years from the date of Owner acceptance. This warranty does not apply to damage resulting from accident, alteration, misuse, tampering, negligence or abuse. The Manufacturer shall repair, replace, or refund the purchase price, of any items found defective upon inspection by Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Anchors for reinstallation of salvaged benches
 - 1. Stainless steel screws and bolts
 - 2. All assembling bolts shall be type 316 stainless steel and tamper proof.
- B. MNR Recycling Center
 - 1. MNR Recycling centers are to be furnished by the contractor and installed by MNR.
 - 2. Recycling center is to be affixed to the platform with epoxy threaded rods, washers, and nuts. Quantity and size per manufacturer's requirements.
 - a. 316 stainless steel
 - 3. Recycling center advertising is to be provided by others.
 - 4. Finish: powder coat

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Ensure surfaces to receive furnishings are clean, flat, and level
- B. Prepare drilled holes for anchors as recommended by anchor manufacturer.

3.3 INSTALLATION

- A. Install site furnishings in accordance with manufacturer's instructions at locations indicated on drawings.
- B. Install furnishings level, plumb, square, accurately aligned, correctly located, and without warp. Provide leveling grout pads.
- C. Anchor furnishings securely in place to concrete with concrete anchor bolts through holes in predrilled flanges. All fasteners to be tamper proof.
- D. Use hardware and fasteners in accordance with manufacturer's instructions.

3.4 CLEANING

- A. Clean furnishings in accordance with manufacturer's instructions.
- B. Remove temporary protective coverings.
- C. Do not use harsh cleaning materials or methods that would damage finish.

3.5 PROTECTION

- A. Protect installed furnishings from damage during construction.

END OF SECTION 12 93 40

SECTION 13 34 19 - PRE-ENGINEERED PLATFORM SHELTERS

PART 1 - GENERAL

1.1 SUMMARY

- A. **Description:** Fabrication and installation of platform shelter as indicated on the Drawings, and as required to complete the work and the project objectives, including, but not limited to, aluminum and glass on concrete platforms.

1.2 SUMMARY

- A. **Section Includes:**
 - 1. Permanent platform shelter
 - 2. Temporary platform shelter
 - 3. TVM shelter

1.3 REFERENCES

- A. ASTM B209 Aluminum and Aluminum Alloy Sheet and Plate.
- B. SMACNA Architectural Sheet Metal Manual.
- C. AAMA 607.1 Voluntary Guide Specification and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.
- D. AAMA 608.1 Voluntary Guide Specification and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.
- E. ANSI X97.1 Safety performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
- F. ASTM E330 Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
- G. FGMA Glazing Manual
- H. CTDOT Standard Specifications, Construction and Materials

1.4 DESIGN REQUIREMENTS

- A. Design shall comply with the requirements of applicable codes and receive approval of Factory

Mutual Research Corporation. Shelters shall conform to the Connecticut Fire Prevention and Building Code and Factory Mutual FM Standard 4880 Class 1 guidelines.

- B. **Loadings:** Design loads shall be developed using the procedures contained in Design Practices and Design Practice Commentary in the MBMA publications, Metal Building Systems Manual, and the Building Code of Connecticut, current edition. The following data shall be used in developing design loads:

1. The maximum factored load combination as defined in Chapter 16, Structural Design, of the Building Code of Connecticut.
2. The Contractor may, at his option, use either Load and Resistance Factor Design (LRFD) or Allowable Stress Design (ASD), using the appropriate load combinations for each method.

- C. **Framing and Structural Members:**

1. Welding of steel shall conform to the requirements of AWS D1.1, current edition. The welding of aluminum shall conform to the requirements of AWS D1.2, current edition.
 - a. Primary framing shall be continuous aluminum members supported by exterior and interior columns at bay spacing indicated on drawings.
 - b. Wind uplift ratings for metal roof panel system: Obtain from UL testing conducted in accordance with "Tests for Wind Uplift Resistance of Roof Assemblies", UL580. Specific information shall be obtained in UL "Building Material Directory" and applicable state codes.

1.5 SUBMITTALS

- A. **General:** Refer to Section Division 1 Procedures
- B. Shop drawings consisting of catalog cuts; design and erection drawings; complete design analysis for lateral loads, uplift, shop painting and finishing specifications; instruction manuals; and other data to clearly describe design, materials, sizes, layouts, construction details, fasteners, and erection.
- C. Shop drawings shall be accompanied by engineering design calculations for structural framing and covering components, signed and sealed by a Professional Engineer registered and licensed in the State of Connecticut stating the design criteria and procedures used and attesting to the adequacy and accuracy of the design.
- D. **Samples and Descriptive Data:**
1. Accessories: One sample of each type of flashing, trim, closures, caps and similar items. Size shall be sufficient to show construction and configurations.
 2. Covering, Roof and Wall: one piece of each type to be used, 9-inches long, full width if less than 6" wide; 6" wide if larger. Sample for factory color finished covering shall be

accompanied by certified laboratory test reports showing that the sheets are produced under a continuing quality control program and that a representative sample has been tested within the past 12 months and has met the quality standards specified.

3. Fasteners: Two samples of each type to be used with statement regarding intended use.
 4. Gaskets and Insulating Compounds: Descriptive data.
 5. Sealant: One sample, approximately 1 pound, and descriptive data.
- E. **Product Data:** Submit manufacturer's specifications, data, and installation instructions for review.

1.6 QUALITY ASSURANCE

- A. The manufacturer must demonstrate acceptable expertise in said product and acceptable to Railroad.
- B. For the actual fabrication of the platform shelters, use only mechanics that are thoroughly trained and experienced in the skills required in the manufacture and fabrication of the units.
- C. **Installer Qualifications:** Installer of pre-engineered platform shelters is a certified installer with documented history installing manufacturer's products according to manufacturer's specifications.
- D. In acceptance or rejection of the manufacture units, no allowance will be made for lack of skill on the part of the fabricator/manufacturer.
- E. The materials must be in full compliance with the contract documents and approved shop drawings.
- F. **Closeout:**
 1. Maintenance Data: Manufacturer's instructions.
 2. Manufacturer is to provide a two (2) year unconditional guarantee for said units against any defects in workmanship or design, in required form, from date of final acceptance by CTDOT.

1.7 PRODUCT HANDLING

- A. **Protection:** Use all means necessary to protect the platform shelters prior to delivery. The preassembled units are to be shipped in protective crating, palletized.
- B. **Replacements:** In the event of damage, repair will be subject to CTDOT's discretion as to whether replacement or repair will be the procedure for damaged units.
- C. **Shipping:** All windowpanes glass to be shipped separately with protective materials to prevent damages

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials as recommended by the Manufacturer, to protect from damage.

PART 2 - PRODUCTS

2.1 SHELTER

A. Shelter Enclosure Components:

1. General:
 - a. Acceptable manufacturer's:
 - 1) Thomas Manufacturing Inc., (908)-810-0030
 - 2) Columbia Equipment Co., Inc. (716)-658-5900
 - 3) Or Approved Equal
2. Materials:
 - a. All materials metal shall be extruded aluminum from 6063-T5 alloy and shall be finished throughout.
 - b. Aluminum panels to be .060 gauge anodized.
 - c. All glass to be 1/4" tempered as per Fed Spec DD-G01403C.
 - 1) The glass shall be covered with a sacrificial 7 mil. Clear film on both sides to protect against vandalism.
 - d. Aluminum structure surfaces shall be scratch resistant, and be able to have graffiti removed easily.
3. The Contractor shall furnish and install complete shelters as shown on the drawings.

B. Finishes:

1. Factory finish extruded Shelter wall framed panels and components so that any part exposed to view upon completion of installation will be uniform in finish and color.
2. Color Anodic Coating: Comply with AAMA 608.1.
 - a. Class 1, AA<12C22A44 color coating electrolytically deposited, 0.7 mil thickness minimum.
3. Anodic Coating: Comply with AAMA 607.1.
4. Class 1, AAM10C22A31 clear coating electrolytically deposited, 0.7 mil thickness

minimum.

C. Aluminum Shelter Walls:

1. Flush Glazing frame system to meet sizes indicated on the drawings, no snap together glazing or framing will be accepted.
2. The standard shelter shall be fire and vandal resistant, and consist of an anodized aluminum frame.

D. Roof Panels:

- a. Permanent shelter
 - 1) As shown on drawings
- b. Temporary and TVM shelter:
 - 1) Standard Flat Roof: Comprised of white, roll formed interlocking pan sections with a 6" fascia/gutter. Standard full perimeter overhang is 4".

E. Concrete Curb:

1. The shelter's base frame shall be anchored to a full width, minimum 12 inch high concrete curb (above top of platform) which is to be installed to deter structural corrosion from snow melting chemicals.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Transmit submittals required by this Section.
- B. Furnish products as indicated.
- C. Ensure substrates are in suitable condition to receive the work of this Section.

3.2 INSPECTION

- A. Building tolerances on the panel system shall not exceed those defined by the panel manufacturer.
 1. 3/8 inch in any 20 foot length.
 2. 3/4 inch over any single roof plane.
- B. Alignment of the panel support system should be checked and defects corrected prior to installing panels.

3.3 ERECTION

- A. Erection shall be in accordance with the approved erection instructions and drawings. Finished structure shall be proven weather-tight. Stained, discolored or damaged sheets shall be removed.
- B. Anchoring system complete per final accepted shop drawings and in full accordance with the manufacturer's specifications and instructions. Minor adjustments to the shelter may be required at time of installation, due to possible variances and irregularities in poured concrete curb.
- C. **Framing and Structural Members:** Uniform bearing under base plates and sill members shall be provided using a non-shrinking grout.
- D. **Metal wall and roof panels:** Wall and roof panels shall be installed to provide proper drainage with the installation of weeps as recommended by the manufacturer and shall be designed with adequate provisions for expansion and contraction, where required.
- E. Caulking and sealant shall be used in joints with surrounding construction to provide watertight construction.
- F. **Field Painting:**
 - 1. Abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same material used for the shop coat.

3.4 ROOF AND WALL PANEL INSTALLATION

- A. Panels shall be installed plumb and true in proper alignment and relation to the structural framing. Panel erector shall demonstrate at least five years of experience installing similar products and applications.
- B. Manufacturer shall provide detailed instructions covering the tools, fasteners, sealants, and assembly procedures required to achieve the structural, thermal, and weathering performance specified.
- C. Wall covering shall be applied with the longitudinal configurations in the vertical position. Roof panels shall be applied with the longitudinal configurations in the direction of the roof slope.
- D. End laps shall be made over framing members with fasteners into framing members approximately 2 inches from the end of the overlapping sheet.
- E. Side laps shall be laid away from the prevailing winds.
- F. Side lap distances, end lap distances, joint sealing, spacing and fastening of fasteners shall be in accordance with the manufacturer's standard practice insofar as the maximum spacing specified is not exceeded and provided such standard practice will result in a structure that will be free from water leaks and meet design requirements.
- G. Panels, trim, accessories, and sealants shall be installed in accordance with approved shop

drawings to insure a functional and weather tight installation.

- H. No exposed roof fasteners will be permitted as part of the structural system.
- I. Dry wipe-down of the exterior surface should be done as the panels are installed.
- J. Remove all strippable coating and provide a dry wipe-down cleaning of the panels as they are erected.
- K. Metal filings caused by cutting and drilling shall be immediately removed from finished surfaces to prevent rusting and staining.
- L. The wall panel systems contractor shall coordinate work with other trades as required to insure proper flashing and seals with adjoining construction.

3.5 DAMAGED MATERIAL

- A. Upon determination of responsibility, repair or replace damaged metal panels and trim to the satisfaction of the architect and/or owner at no additional cost to owner.

END OF SECTION 13 34 19

SECTION 23 82 46 - ELECTRIC UNIT HEATERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This work shall consist of providing a wall-mounted heavy-duty electric unit heater, as indicated in the contract plans, and arranging for discharge of air as indicated.

1.2 SUBMITTALS

- A. Submit the following in accordance with the NOTICE TO CONTRACTOR – SUBMITTALS:
 - 1. Product Data
 - a. Equipment and Performance Data
 - b. Electric Unit Heaters
 - 2. Manufacturer's Instructions
 - a. Manufacturer's Instructions

1.3 QUALITY ASSURANCE

- A. Codes, Regulations, Reference Standards and Specifications:
 - 1. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.
 - a. UNDERWRITERS LABORATORIES (UL)
 - 1) UL 1025 : UL Standard for Safety Electric Air Heaters

1.4 RELATED DOCUMENTS

- A. SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL applies to work specified in this section.

PART 2 - PRODUCTS

2.1 PRODUCT STANDARDS

- A. Provide products conforming to the requirements of UL 1025 for electric unit heaters.

- B. Unit heaters shall be manufactured by Trane, Reznor, TPI Corporation or approved equal.

2.2 PRODUCT DESCRIPTION

- A. Provide wall-mounted heavy-duty electric unit heaters and arrange for discharge of air as indicated.
- B. Provide electric unit heaters with not less than the indicated capacity and conform to requirements specified herein. Ensure electric unit heaters are factory rewired, ready for field terminal connections. Ensure compatibility of unit heater with existing electrical system voltage and phase. Wall-mounted heater shall extend no more than 6" from finished wall surface.

2.3 CASINGS

- A. Construct casings with smoothly contoured metal of not less than 16-gage cold-rolled carbon steel. Provide casing surface finish with phosphate pretreatment, prime coating, and high gloss baked-enamel finish.
- B. Front enclosure shall be able to withstand 10.8 ft-lbs impact and 400 lbs static force applied to an 8-inch square area at center grille location with less than 1/16" distortion. Combination supply and return grille assembly shall be constructed of 1/16" by 3/8" rounded edge horizontal steel. Louvers shall be spaced for a maximum opening of 1/4". Louvers shall be welded at every intersection to three evenly spaced vertical members, completely framed with an anodized aluminum extrusion.

2.4 AIR DISTRIBUTION

- A. Heater shall provide an even distribution of air to the space by drawing return air across heating element and discharged from center section of the heater by means of an electric motor and axial flow fan blade.

2.5 HEATING ELEMENT

- A. Construct heating element of a resistance wire insulated by highly compacted refractory insulation protected by a sealed metallic-finned sheath. Component materials are as follows:
 1. Element shall consist of two or three corrosion resistant steel sheathed type elements mechanically bonded to corrosion-resistant steel fins.
 2. Each sheathed element shall consist of helically coiled nickel chrome alloy wire completely embedded in and surrounded by magnesium oxide, enclosed and wedged into corrosion-resistant steel sheaths.
 3. Elements shall have 2" cold conductor pins extending into the sheath and shall have a density of no more than 60 watts per inch.

2.6 CONTROLS

- A. Provide unit with a remote unfused disconnect switch that opens ungrounded conductors in the OFF position and a thermostat with integral controls including thermal overload cutout switches, magnetic contactors, necessary transformers, and thermostat protection as required. Provide automatically resettable cutout switches.
- B. Provide integrally mounted thermostat heavy-duty hydraulic-type with a range of 40° F to 80° F with sensing bulb placed in the return air.
- C. Thermostat can also serve as a disconnect by breaking all ungrounded conductors in the OFF position, if in compliance with NEC requirements.
- D. Thermostat control knob shall be covered by a 16 gauge tamper-resistant access plate to prevent adjustment by anyone other than authorized personnel.

2.7 FANS AND MOTORS

- A. Provide propellers with mill-aluminized statically and dynamically balanced to within 0.5 percent. Provide units with fan-inlet safety guards.
- B. AMCA certify propellers and motors for air performance and noise level.
- C. Protect motors against damage by the heating element and resilient mount.
- D. Motors shall be permanently lubricated unit bearing, totally enclosed, shaded pole type with impedance protection. Motors shall operate at 1400 RPM maximum and shall be same voltage as the heater.
- E. Provide motor identification plate per manufacturer's standard.

2.8 THERMAL OVERLOAD

- A. Heaters shall be equipped with 'zero voltage reset' thermal overload to disconnect elements and motor in the event that normal operating temperatures are exceeded.

2.9 WARRANTY

- A. Heater shall be warranted for a period of 5 years.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install unit heaters in accordance with the manufacturer's instructions at the mounting height indicated.

3.2 FIELD TESTING

- A. Demonstrate in the presence of the Department's representative that the unit heaters operate satisfactorily.
- B. Cycle unit heaters five times, from start to operating thermal conditions to off, to verify adequacy of construction, system controls, and component performance.
- C. Conduct an operational test for a minimum of 6 hours.

END OF SECTION 23 82 46

SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electrical installation requirements.

1.2 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.3 SUBMITTALS

- A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS.
- B. Product Data: For sleeve seals.
- C. Quality Assurance Submittals:
 1. Manufacturer Certification Letter in accordance with NOTICE TO CONTRACTOR - POTENTIAL FOR ASBESTOS CONTAINING MATERIALS.
 2. Source quality-control test reports.
 3. Field quality-control test reports.

1.4 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 3. To allow right of way for piping, duct, and conduit installed at required slope.
 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment per NFPA 70.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed.
- D. Coordinate sleeve selection and application with selection and application of firestopping.

1.5 WARRANTY

- A. Refer to Form 816 Article 1.20-1.06.08 and NOTICE TO CONTRACTOR – WARRANTIES

for additional information.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Form 816 Article 1.06.03 and Form 816 Article 1.20-1.06.03 for additional information.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 80, galvanized steel, plain ends.

2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Or approved equal.
 - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 3. Pressure Plates: Stainless steel. Include two for each sealing element.
 - 4. Withstand Pressure: Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.
 - 5. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
 - 1. Withstand Pressure: Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

PART 3 – EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. All electrical components shall be installed per requirements of NFPA 70, NFPA 70E, and other codes identified in the Contract Documents.
- C. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- D. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

- E. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- F. Right of Way: Give to piping systems installed at a required slope.

3.2 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Acceptance Testing Preparation:
 - 1. Test continuity of each circuit.
- E. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.3 INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve for all electrical applications. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal for all below grade penetrations.
- B. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- C. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- D. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both surfaces of walls.
- G. Extend sleeves installed in floors 4 inches above finished floor level unless otherwise indicated.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise or unless seismic criteria require different clearance.
- I. Seal space outside of sleeves with grout for penetrations of concrete, masonry, and with approved joint compound for gypsum board assemblies.

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
 - J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section 07 92 00 "Joint Sealants."
 - K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials.
 - L. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
 - M. Aboveground, Exterior-Wall Penetrations: Provide insulation equal to the architectural indicated "R" factor of the assembly and seal penetrations using non-shrink grout. Grout shall be applied on both the interior and exterior building face.
 - N. Underground, Exterior-Wall Penetrations: Install fiberglass reinforced epoxy pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal. The conduit shall be sealed on both the interior and exterior foundation face with the ability to withstand a minimum of 30 psig.
 - O. Underground, Floor Penetrations: See electrical details on plans for requirements.
- 3.4 SLEEVE-SEAL INSTALLATION
- A. Install to seal underground, exterior wall penetrations.
 - B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- 3.5 FIRESTOPPING
- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly.

END OF SECTION 26 05 00

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART I – GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
 - 3. Sleeves and sleeve seals for cables.
- B. Related Sections include the following:
 - 1. Division 27 Section 27 51 16, Public Address and Mass Notification Systems.
- C. DEFINITIONS
 - 1. EPDM: Ethylene-propylene-dieneterpolymer rubber.
 - 2. NBR: Acrylonitrile-butadiene rubber.
- D. SUBMITTALS
- E. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS.
- F. Product Data: For each type of product indicated.
- G. Qualification Data: For testing agency.
- H. Field quality-control test reports.
- I. Quality Assurance Submittals:
 - 1. Manufacturer Certification Letter in accordance with NOTICE TO CONTRACTOR - POTENTIAL FOR ASBESTOS CONTAINING MATERIALS.
 - 2. Source quality-control test reports.
 - 3. Field quality-control test reports.
- J. QUALITY ASSURANCE
 - 1. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 2. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
 - 3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 4. Comply with NFPA 70.

K. COORDINATION

1. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

L. WARRANTY

1. Refer to Form 816 Article 1.20-1.06.08 and NOTICE TO CONTRACTOR – WARRANTIES for additional information.

M. DELIVERY, STORAGE, AND HANDLING

1. Refer to Form 816 Article 1.06.03 and Form 816 Article 1.20-1.06.03 for additional information.

PART 2 – PRODUCTS**2.1 NON-EMERGENCY CONDUCTORS AND CABLES**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. American Insulated Wire Corp.; a Leviton Company.
General Cable Corporation.
Southwire Company.
Or approved equal.
- C. Copper Conductors: Comply with NEMA WC 70.
- D. Conductor Insulation: Comply with NEMA WC 70 and UL 44 for Types XHHW-2.
- E. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC; Type MC cable shall be allowed on and above the third floor only.

2.2 EMERGENCY CONDUCTORS AND CABLES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Raychem.
 2. BICC General.
 3. Or approved equal.
- B. Copper Conductors: Annealed copper designed to ensure tensile strength under fire conditions.
- C. Conductor Insulation: Thermoset, low smoke, zero halogen silicone rubber, with cross-linked polyolefin jacket Type RHW, listed per UL 44 or compacted refractory magnesium oxide with seamless, phosphorous deoxidized copper sheath Type MI (mineral insulated). Individual ground conductor(s) shall be provided for each circuit.
- D. The conductor shall be at a minimum listed 600V, 90 degree C dry or 75 degree C wet with ampacities derived from NFPA 70 Tables 310.16, 75 degree C Column. Termination temperatures shall be rated 90 degree C.

- E. Two (2) hour fire-rated per UL 2196 and UL Fire Resistance Directory either installed in conduit or in free air and meeting the requirements of an “Electrical Circuit Protective System” as referred in NFPA 70 Articles 695 and 700. Either type material shall be capable of being installed in conduit sleeves.
- F. The Contractor shall install the conductor or cable in accordance to all manufacturer recommendations which include but not limited to providing all terminations, junction boxes, and fittings. Support spacing shall be at maximum five (5) foot intervals.
- G. Required emergency conductors are defined in the IBC, NFPA 70, NFPA 72, and NFPA 101. Additional emergency conductors are indicated on the Contract Plans.
- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. O-Z/Gedney; EGS Electrical Group LLC.
 - 2. 3M; Electrical Products Division.
 - 3. Tyco Electronics Corp.
 - 4. Or approved equal.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. All conductors shall be Stranded.
- B. Branch Circuits: Copper. All conductors shall be Stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type XHHW or Type XHHW-2, single conductors in raceway; Type RHW, or Type MI for emergency circuits, listed as 2-hour fire rated when installed in conduit or free air for Type MI.
- B. Feeders Exposed: Type XHHW or Type XHHW-2, single conductors in raceway; Type RHW, listed UL 44 or Type MI for emergency circuits, listed as 2-hour fire rated when installed in conduit or free air for Type MI.
- C. Feeders Concealed in Ceilings, Walls, Partitions: Type XHHW or Type XHHW-2, single conductors in raceway; Type RHW or Type MI for emergency circuits, listed as 2-hour fire rated when installed in conduit or free air for Type MI.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW or Type XHHW-2, single conductors in raceway; Type RHW for emergency circuits, listed as 2-hour fire rated when installed in conduit.
- E. Branch Circuits Exposed: Type XHHW or Type XHHW-2, single conductors in raceway; Type RHW or Type MI for emergency circuits, listed as 2-hour fire rated when installed in conduit or free air for Type MI.
- F. Branch Circuits Concealed above Acoustic Ceilings: Type XHHW or Type XHHW-2, single conductors in raceway or Type MC metal-clad listed UL 1596; Type RHW or Type MI for emergency circuits, listed as 2-hour fire rated when installed in conduit or free air for Type MI.

- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW or Type XHHW-2, single conductors in raceway; Type RHW for emergency circuits, listed as 2-hour fire rated when installed in conduit or free air for Type MI.
- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means; including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support the exposed cables appropriately per the Industry Standards.
- F. Identify and color-code conductors and cables according to Division 26 Section 26 05 53 "Identification for Electrical Systems."
- G. Install through walls and floors according to Division 26 Section 26 05 00 "Common Work Results for Electrical".

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 FIELD QUALITY CONTROL

- A. Inspect and test conductors and cables in accordance with Form 816 Article 1.20-1.05.10 and as follows:
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- C. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors to all equipment indicated on the one-line diagram including the critical equipment.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- D. Test Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.

3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
 - a. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 05 19

SECTION 26 05 20 – NO. 10 SINGLE CONDUCTOR

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work under this item consists of furnishing and installing the No. 10 single conductors as shown on the plans and specified herein for improvements at the rail line station. The No. 10 single conductors shall be placed in conduit and shall comply with the specifications for conduits, outlet boxes, pull and junction boxes, wires and cables, grounding, etc. and meet the requirements of the National Electrical Code and the technical and safety recommendations of ANSI and IEEE.
- B. Applicable Standards: Pertinent provisions of the following listed standards (latest edition) shall apply to the work of this Section, except as they may be modified herein, and are hereby made a part of this Specification to the extent required.

Organization	Number	Title
NFPA	70	National Electrical Code
UL	44	Rubber-Insulated Wires and Cables
UL	83	Thermoplastic-Insulated Wires and Cables
UL	98	Test for Flammability of Plastic Materials for Parts for Devices and Appliances
UL	486A	Wire Connector and Soldering Lugs for Use with Copper Conductors
UL	486C	Splicing Wire Connectors
UL	514A	Metallic Outlet Boxes
UL	514B	Fittings for Conduit and Outlet Boxes
UL	719	Nonmetallic-Sheathed Cables
ASTM	B1	1990 Hard-Drawn Copper Wire
ASTM	B8	Concentric lay-stranded copper conductors, hard, medium hard or soft

1.2 SUBMITTALS

A. Product Data:

- The Contractor shall submit product data for all components of this Section, which shall include shop/working drawings, material/procurement specifications and other related information for each component.

B. Test Reports:

1. Reports of all field tests shall be submitted to the Engineer as required by these specifications and reference standards.
2. Certified copies of test results on cables and other materials, supplied under this Section, as per relevant standards.

C. Certifications:

1. The Contractor shall furnish from each manufacturer supplying cable certification that the cable shall have a qualified life equal to 40 years. Certifications shall be signed by an officer of the manufacturing company. The Contractor shall, as part of the shop drawings required for each cable type, submit basic type tests. These tests shall comply with all applicable standards. Test acceptance criteria is established in the applicable standard unless otherwise specified.

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. Conductors for lighting shall be ASTM B8, Class B stranded annealed copper and sized as indicated on the plans.
- B. Conductors for lighting shall be 600 volt and shall be annealed, uncoated, stranded copper conductors with polyvinyl chloride (PVC) insulation. The cables shall be Type THHN, THWN, VW-1 with a 90°C dry/75°C wet rating. A nylon jacket shall be applied over the insulation.
- C. The conductors shall be annealed, uncoated copper with Class B stranding per ASTM B-8. The insulation shall be PVC, shall meet UL 83 and shall have the following thicknesses:

<u>Cable Size</u>	<u>Insulation Thickness</u>
10 AWG	20 Mils

- D. The jacket shall be nylon and shall meet UL 83. The jacket shall have the following thicknesses:

<u>Cable Size</u>	<u>Jacket Wall Thickness</u>
12-8 AWG	4 Mils

- E. Manufacturers and their particular products are as follows: Okonite "N-Type", Rome "THWN or THHN", Other Manufacturers who meet the above requirements, or approved equal.

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS

- A. Electrical installation shall, as a minimum, meet the requirements of the National Electrical Code (NEC), local codes and the requirements specified herein.
- B. The locations and routings of conduit, unless specifically dimensioned, are diagrammatic. The Contractor shall make adjustments to conduit routings to suit field conditions as required.
- C. The locations shown on drawings of electrical equipment may be adjusted to suit specific dimensions of a particular manufacturer.
- D. Wiring method shall be insulated conductors installed in conduit except where specifically indicated or specified otherwise or required by the NEC to be installed otherwise.
- E. Where stranded wires are terminated at panels, and/or devices connections shall be made by solderless lug, crimp type ferrule or solder dipped.
- F. Cable shall not be flexed or pulled when the temperature of the insulation or of the jacket is such that damage will occur due to low temperature embrittlement.
- G. When cable will be pulled with an ambient temperature within a three day period prior to pulling of 40oF or lower, cable reels shall be stored during the three day period prior to pulling in a protected storage with an ambient temperature not lower than 55oF and pulling shall be completed during the work day for which the cable is removed from the protected storage.
- H. Conductor jacket shall be color coded as follows:

AC Power 480V and above	208Y/120V System
Phase A - Brown	Phase A - Black
Phase B - Orange	Phase B - Red
Phase C - Yellow	Phase C - Blue
Neutral - White	Neutral - White
Ground - Green	Ground - Green

- I. The wires and cables shall be installed in conduits along the underside of rail line platforms, racked on walls, on columns, between columns, as specified herein and as indicated on the Contract Drawings or as directed by the Engineer.
- J. The method of pulling cable through conduits shall be subject to the approval of the Engineer. Cable reels shall be set upon jacks in such position that the cable can be fed from them freely, without distortion or injury, into the ducts or conduits through an approved type bell or shield. Extreme care must be used in installing cable so as to avoid twisting, kinking, or in any way injuring the cable or its sheath.
- K. Cables must not be installed until all supports and housings are in place, completely installed. Where required, shields of heavy fiberglass or approved equal, shall be provided to prevent cables from touching or rubbing against walls, concrete surfaces or columns. The heavy phenolic boards shall be painted with two coats of approved fire retardant paint.
- L. Where more than one wire or cable is installed in any one conduit run, all such wires and cables shall be pulled in at the same time.
- M. Cable pulling compounds shall be non-injurious to the cable and shall be approved by the Engineer.
- N. After the cable has been installed, the ends of the cable shall be immediately sealed until such time as the cable is spliced or otherwise terminated.
- O. Cables entering at the top of vertical conduits shall be held rigidly in place by the use of O.Z./Gedney Company type cable wedges, or approved equal, oakum and insulating compound, or other approved means. Horizontal runs and bottoms of vertical conduits shall be packed with oakum only. The ends of all conduits shall be terminated by means of suitable bushings. Where cables emerge from ducts, said ducts shall be effectively blocked by approved means to prevent access of rodents.
- P. A nonmetallic sheathed cable shall not be bent to a radius less than eight times its diameter, a lead covered cable shall not be bent to a radius less than ten times its diameter and a shielded power or control cable shall not be bent to a radius less than fifteen times its diameter. Wire and cable less than one-half inch diameter may be bent to smaller radii if so directed by the Engineer. Making short bends in any cable, or bending such cable over corners of structures, timbers, or the ends of conduit, will not be permitted.
- Q. All wire and cable lengths shall be continuous and without splices in conduits between the points of connections, and sufficient slack shall be provided for the proper make-up of such connections. In duct manholes, splices shall be provided as required by the Engineer. Where

cables are installed in ducts or conduits from manholes to other manholes or enclosures, splices in manholes shall be centrally located, except where otherwise specified.

- R. Splices shall not be made in any wires or cables unless approved by the Engineer. Every splice shall have conductivity at least equal to that of the wire or cable. New and existing cables shall be spliced or otherwise connected as indicated on the Contract Drawings.

- S. Splices shall be made in accordance with Metro-North Railroad standards, copies of which may be obtained at the office of Metro-North. Where no such standards exist, splices shall be made in accordance with the cable manufacturer's recommendations and shall be approved by the Engineer. The Contractor shall submit for approval splicing kits, and also drawings if required, in accordance with such standards or recommendations. Solid conductors, and stranded conductors, No. 4 AWG and smaller, shall have their ends neatly stripped of insulation, and the said ends shall be provided with self-insulated, mechanical terminals, T&B "Sta-Kon", or approved equal, and securely fastened to study by clamping nuts or other approved means. An individual nut shall be used for each conductor. These terminals shall be installed with a tool which automatically insures the correct depth of indentation, T&B No. WT-145A, or approved equal. All wiring to terminal connectors shall be neatly dressed, and there shall be no nicks in the conductors where the insulation has been stripped. All terminal connections shall be made up in such manner that no loose connections shall exist or develop when the wires or cables are put into service. Cable connections shall be made in accordance with the connection diagrams in the Contract Drawings. Where required, wires shall be bundled together with non-combustible nylon tie straps, T&B, or approved equal. Before cutting any existing cable, the Contractor shall make sure the cable has been properly identified, de-energized and grounded or otherwise made safe. The ends of cables that are cut made idle and left in place shall be sealed in an approved manner. Lead covered splices or other connections shall become the property of the Contractor. Where necessary, existing cables will be tested before any work is done on them by the Contractor. These tests and any phase rotation tests before and proof tests after will be made by the forces and with the equipment of Metro- North. Splices failing under proof tests shall be replaced at the Contractor's expense. Where the Contractor disturbs existing circuits, all wires shall be disconnected in the boxes and the exposed ends taped and tagged. Field testing shall be thorough, continuing throughout the installation, and fully documented, with the following as a minimum:

- T. The Contractor shall show by demonstration in service that all circuits and devices are in operating condition. Tests shall be such that each item of control equipment will function not less than 5 times.

- U. Test all 600-volt wiring to verify that no short circuits or accidental grounds exist. Tests shall be made using an instrument that applies a voltage of approximately 500 volts to provide a direct reading of resistance.

END OF SECTION 26 05 20

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. The work under this item consists of furnishing and installing the grounding and bonding systems as shown on the plans and specified herein for improvements at the rail line station. The grounding and bonding systems shall meet the requirements of the National Electrical Code and the technical and safety recommendations of ANSI and IEEE.
- B. Applicable Standards: Pertinent provisions of the following listed standards (latest edition) shall apply to the work of this Section, except as they may be modified herein, and are hereby made a part of this Specification to the extent required.

<u>Organization</u>	<u>Number</u>	<u>Title</u>
NFPA	70	National Electrical Code
NFPA	78	Lighting Protection Code
IEEE	81	Ground Resistance and Potential Gradients in the Earth, Recommended Guide for Measuring
IEEE	142	IEEE Recommend Practice for Grounding of Industrial and Commercial Power Systems
UL	467	Grounding and Equipment
ASTM	B8	Concentric lay-stranded copper conductors, hard, medium hard or soft

1.2 SUBMITTALS:

- A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS.
- B. Product Data: For each type of product indicated.
- C. Other Information Submittals:
 - 1. Including the pedestrian bridge , canopy structures
- D. Qualification Data: For testing agency and testing agency's field supervisor.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:
 - 1. Instructions for periodic testing and inspection of grounding features.
 - a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
 - b. Include recommended testing intervals and reference standards
- G. Test Reports: Reports of all field tests shall be submitted to the Engineer as required by these specifications.

H Certified copies of test results on cables and other materials, supplied under this Section,
as per relevant standards.

I. The Contractor shall submit product data for all components of this Section, which shall include shop/working drawings, material/procurement specifications and other related information for each component.

1.3 MATERIALS:

- A. Conductor's for grounding, bonding and rail return cables shall be ASTM B8, Class B stranded annealed copper and sized as indicated on the plans.
- B. Connector's and Clamps: Bolts, washers and stop nuts shall be of high-copper alloy, Everdur, Durium, Duronze or silicone bronze Ferrous hardware will not be acceptable.
- C. Ground wire shall be 4/0 AWG Copperweld - copper conductor, Type "E" Messenger Wire as indicated on the plans.
 - a. Tests shall be done to determine if the ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
 - b. Include recommended testing Intervals

1.4 METHODS:

- A. Ground tap connections from the equipment to the grounding structural members shall be provided as required. All paint, scale, rust, oxidation, or other foreign material shall be thoroughly removed from the points of contact on all metal surfaces before any ground connections are made.
- B. Field testing shall be thorough, continuing throughout the installation, and fully documented, with the following as a minimum:
- C. Electrical resistance tests shall be made during installation to verify continuity of the grounding system.
- D. Measure, record, and report the ground resistance at each location where grounding system is installed. The required ground resistance of the completed system shall be 5 ohms or less.
- E. Corrective measures shall be taken by the Contractor to achieve the specified ground resistance.
- F. Resistance-to-earth tests shall be witnessed by the Engineer and written results of these tests shall be submitted to him for evaluation and approval.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authority having jurisdiction, and marked for intended use.

- C. Comply with UL 467 for grounding and bonding materials and equipment.

1.6 WARRANTY

- A. Refer to Form 816 Article 1.20-1.06.08 and NOTICE TO CONTRACTOR – WARRANTIES for additional information.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Form 816 Article 1.06.03 and Form 816 Article 1.20-1.06.03 for additional information.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors for other than bonding the rail (train track): Single conductor copper wire insulated for 600 V shall be sized as indicated on the Contract Plans and in accordance to the NFPA 70. The conductors shall be Type XHHW or XHHW-2
- B. Bare Copper Conductors (grounding and bonding):
Solid Conductors: ASTM B 3.
 - 1. Stranded Conductors: ASTM B 8.
 - 2. Tinned Conductors: ASTM B 33.
 - 3. Bonding Cable: 4/0 AWG min. or as indicated on the Contract Plans, whichever is larger.
 - 4. Bonding Conductor: 4/0 AWG min. or as indicated on the Contract Drawing, whichever is larger.
 - 5. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick or insulated conductor per NFPA 70.
 - 6. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, unless otherwise indicated; with insulators, see details on plans.

2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING RODS

- A. Ground Rods: Copper-clad steel; 3/4 inch diameter by 10 feet long.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install stranded conductors, unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 4/0 AWG minimum unless otherwise indicated in the Contract Plans.
 - 1. Bury at least 24 inches below grade.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Grounding Bus: Install in Electrical, Emergency Electrical, IT/Communication, and Security Rooms, in rooms housing service equipment, and elsewhere as indicated on the Contract Documents.
 - 1. Install bus as indicated on the Contract Plan details.
- E. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Exothermic welds.
 - 3. Connections to Ground Rods at Test Wells: Exothermic welds.
 - 4. Connections to Structural Steel: Exothermic welds.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Armored and metal-clad cable runs.
 - 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or physical damage.
- B. Ground Rods: Drive rods until tops are 6 inches below finished floor or final grade, unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
 - 2. For grounding electrode system, install rods spaced at least one-rod length from each other and located in at least the locations as indicated on the Drawings; provide additional grounding electrodes per the requirements of the National Electrical Code. Connect to the service grounding electrode conductor.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:
 - 1. Domestic Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity. Coordinate locations with the Mechanical Contractor.
- F. Grounding for Steel Building Structure: Install bonding jumpers as indicated on the Contract Plans.

3.4 FIELD QUALITY CONTROL

- A. Inspect and test grounding and bonding systems in accordance with Form 816 Article 1.20-1.05.10 and as follows:
- B. Testing Agency: The Contractor shall engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
 - 1. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

- a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
- 2. Prepare dimensioned plans locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- C. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 5 ohms.
 - 2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
 - 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 5 ohms.
 - 4. Power Distribution Units or Panelboards Serving Electronic Equipment: 5 ohms.
 - 5. Substations and Pad-Mounted Equipment: 5 ohms.
 - 6. Manhole Grounds: 5 ohms.
- D. Excessive Ground Resistance: If resistance to ground exceeds specified values mentioned above, notify Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following: None.

1.2 DEFINITIONS

- A. RMC: Rigid Metal Conduit (also known as RGS; Rigid Galvanized Steel Conduit).
- B. EMT: Electrical Metallic Tubing.
- C. RNC: Rigid Nonmetallic Conduit.
- D. PVC: Polyvinyl Chloride.
- E. FRE: Fiberglass Reinforced Epoxy.
- F. LFMC: Liquidtight Flexible Metal Conduit.
- G. LFNC: Liquidtight Flexible Nonmetallic Conduit.

1.3 SUBMITTALS

- A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS.
- B. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- C. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Custom enclosures and cabinets.
- D. Coordination Plans: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Structural members in the paths of conduit groups with common supports.
 - 2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.
- E. Quality Assurance Submittals:
 - 1. Manufacturer Certification Letter in accordance with NOTICE TO CONTRACTOR - POTENTIAL FOR ASBESTOS CONTAINING MATERIALS.
 - 2. Source quality-control test reports.
 - 3. Field quality-control test reports.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.5 WARRANTY

- A. Refer to Form 816 Article 1.20-1.06.08 and NOTICE TO CONTRACTOR – WARRANTIES for additional information.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Form 816 Article 1.06.03 and Form 816 Article 1.20-1.06.03 for additional information.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Allied Tube & Conduit; a Tyco International Ltd. Co.
 2. Anamet Electrical, Inc.; Anaconda Metal Hose.
 3. Electri-Flex Co.
 4. Manhattan/CDT/Cole-Flex.
 5. O-Z Gedney; a unit of General Signal.
 6. Wheatland Tube Company.
 7. Or approved equal.
- B. RMC: Galvanized Steel, ANSI C80.1, UL 6.
- C. EMT: Steel, ANSI C80.3, UL 797.
- D. PVC-Coated Rigid Metal Conduit:
 1. Comply with NEMA RN 1.
 2. Coating Thickness: 0.040 inch, minimum.
- E. LFMC: Flexible steel conduit with PVC jacket, UL 360.
- F. Fittings for Conduit (Including all Types and Liquidtight), EMT and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
 1. Conduit Fittings for Hazardous (Classified) Locations as indicated on the Contract Plans: Comply with UL 886.
 2. Fittings for EMT: Steel, set-screw or compression type.
 3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.
- G. Joint Compound for RMC or PVC-Coated Rigid Metal Conduit: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Electri-Flex Co.
 2. Lamson & Sessions; Carlon Electrical Products.
 3. RACO; a Hubbell Company.
 4. Champion.
 5. Or approved equal.
- B. RNC: NEMA TC 2, Type EPC-80-PVC, UL 651, unless otherwise indicated.

- C. FRE: Extra Heavy Wall type, all joints shall be inside tapered bell end and of even socket depth throughout the raceway.
- D. LFNC: UL 1660.
- E. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.
- F. Fittings for LFNC: UL 514B.

2.3 METAL WIREWAYS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cooper B-Line, Inc.
 - 2. Hoffman.
 - 3. Square D; Schneider Electric.
 - 4. Or approved equal.
- B. Description: Sheet metal sized and shaped as indicated, UL 870, NEMA 250, Type 12 in dry locations and 3R for wet or damp locations and as defined per NFPA 70, unless otherwise indicated.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Screw-cover type or Flanged-and-gasketed type, as defined per NFPA 70, unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 - 2. Hoffman.
 - 3. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
 - 4. Or approved equal.
- B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- F. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, with gasketed cover.
- G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- H. Cabinets:
 - 1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.

2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.5 HANDHOLES AND BOXES FOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.

1. Color of Frame and Cover: Gray.
2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC", "COMMUNICATION", or as identified on the Contract Plans.
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
7. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
 - 1) Armorcast Products Company.
 - 2) Carson Industries LLC.
 - 3) CDR Systems Corporation.
 - 4) Or approved equal.

C. Fiberglass Handholes and Boxes with Polymer-Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester-resin enclosure joined to polymer-concrete top ring or frame.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.
 - d. Or approved equal.

2.6 SLEEVES FOR RACEWAYS

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping.

2.7 SLEEVE SEALS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Advance Products & Systems, Inc.
 - 2. Metraflex Co.
 - 3. Pipeline Seal and Insulator, Inc.
 - 4. Or approved equal.
- B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
 - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 2. Pressure Plates: Stainless steel. Include two for each sealing element.
 - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Exterior: Apply raceway products as specified below, unless otherwise indicated:
 - 1. Exposed Conduit: RMC.
 - 2. Concealed Conduit, Aboveground: RMC.
 - 3. Concealed Conduit, Belowground: RMC or PVC. However, identified emergency and stand-by circuits shall always be in RMC.
 - 4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R unless otherwise indicated.
- B. Interior: Comply with the following applications, unless otherwise indicated:
 - 1. Exposed: RMC from finished grade to at least ten (10) feet above finished floor. EMT may be substituted when mounted greater than ten (10) feet above finished floor.
 - 2. Concealed in Ceilings and Interior Walls or partitions: RMC or EMT and as identified per Codes.
 - 3. Risers between Floors: RMC.
 - 4. Third floor and above, EMT unless otherwise indicated.
 - 5. Connection to Vibrating Equipment (Including but not limited to Transformers, damp or wet locations, Hydraulic, Electric Solenoid, or Motor-Driven Equipment): LFMC, below ten (10) feet from finished floor and LFNC may be substituted when above ten (10) feet from finished floor and as identified per Codes.
 - 6. Damp or Wet Locations: RMC.

- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Minimum Flexible Conduit Size: 1/2-inch trade size.
- E. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. RMC: Use threaded rigid galvanized steel conduit fittings, unless otherwise indicated.
 - 2. PVC Externally Coated, rigid galvanized steel conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Plans or in this Article are stricter.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways appropriately per the industry standards
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Conceal conduit within finished walls, ceilings, and floors, unless otherwise indicated. Conduits in the shop area that travel perpendicular to the roof joists shall be mounted at least ten (10) feet above finished floor.
- G. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings; see architectural and structural plans for maximum anticipated expansion.
 - 3. Change from Type EPC-80-PVC to RMC before rising above the floor.
- H. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Exterior Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating grounding bushings to protect conductors, including conductors smaller than No. 4 AWG.
- J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- K. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - 1. Where conduits travel from interior to exterior locations.
 - 2. Where otherwise required by NFPA 70.
- L. Expansion/Deflection-Joint Fittings for RNC or EMT: Install in each run of conduit that has straight-run length that exceeds 100 feet. Install additional fittings as required per NEC.
 - 1. Install expansion-joint fittings for each of the following locations:

- a. At building expansion locations indicated on the Electrical Plans, see architectural and structural plans for maximum anticipated expansion.
 - 2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.
 - 3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
 - 4. Install fitting(s) that provide deflection of at least one (1) inch for each 100 foot run.
 - M. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- 3.3 PROTECTION
- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Issuance of Certificate of Compliance.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. The work of this Section Includes furnishing and installation of the following:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground –line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.

1.2 SUBMITTALS

- A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR - SUBMITTALS.
- B. Product Data: For each electrical identification product indicated.
- C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.
- D. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.4 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Plans, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

1.5 WARRANTY

- A. Refer to Form 816 Article 1.20-1.06.08 and NOTICE TO CONTRACTOR – CLOSEOUT DOCUMENTS for additional information.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Form 816 Article 1.06.03 and Form 816 Article 1.20-1.06.03 for additional information.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field
 - 2. Legend: Indicate voltage and service.
- C. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Colors for Raceways Carrying Circuits at 600 V and Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.5 UNDERGROUND-LINE WARNING TAPE or BELOW CONCRETE SLAB

- A. Tape:
 - 1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications lines.

2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE and HIGH VOLTAGE.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CCTV CABLE, COMMUNICATIONS CABLE, SECURITY CABLE, and OPTICAL FIBER CABLE.

C. Tag: Type I:

1. Pigmented polyolefin, bright-colored, continuous-printed on one side with the inscription of the line, compounded for direct-burial service.
2. Thickness: 4 mils.
3. Weight: 18.5 lb/1000 sq. ft.
4. 3-Inch Tensile According to ASTM D 882: 30 lbf, and 2500 psi.

2.6 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Rigid Plastic Warning Signs:

1. Weather-resistant, nonfading, preprinted, .050 inch thick polystyrene material; and with colors, legend, and size required for application.
2. Standard with radius corners and pre-drilled corner mounting holes for self tapping stainless screws.
3. Standard size, 10 inches high by 14 inches wide.
4. Oversized custom signs size, 20" high by 28 inches wide, lettering shall be minimum 2 inch high.

D. Standard size warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
3. Equipment Warning per NEC: "DANGER - ELECTRICAL SHOCK HAZARD."

E. Oversized warning signs shall include, but are not limited to, the following legends:

1. "FIRE ALARM CONTROL PANEL AND FIRE PUMP ROOM"
2. "BUILDING ELECTRIC DISCONNECT ROOM"
3. "DC POWER SYSTEM SHUNT TRIP DISCONNECT PUSH BUTTON"

2.7 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.

1. Self-Adhesive engraved legend with black letters on white face.
2. Punched or drilled for stainless steel self-tapping screws.

2.8 EQUIPMENT IDENTIFICATION LABELS

- A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed and punched or drilled for stainless steel self-tapping screws, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

2.9 CABLE TIES

- A. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, Type 6/6 nylon.
 1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
 3. Temperature Range: Minus 40 to plus 185 deg F.
 4. Color: Black.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 1. Exterior: UV-stabilized nylon.
 2. In Spaces Handling Environmental Air: Plenum rated.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30A, and 120V to ground: Identify with self-adhesive vinyl tape applied in bands. Install labels at 10-foot maximum intervals.
- B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for feeder and branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if

authorities having jurisdiction permit.

- b. Colors for 208Y/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral: White.
 - 5) Ground: Green.
- c. Colors for 480Y/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - 4) Neutral: Natural Gray.
 - 5) Ground: Green.
- d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- C. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Plans, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- E. Workspace Indication: Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated.
- F. Warning Labels for Interior Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels punched or drilled for stainless steel self-tapping screws.
 - 1. Comply with 29 CFR 1910.145.
 - 2. Identify system voltage with black letters on an orange background.
 - 3. Apply to exterior of door, cover, or other access.
 - 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
 - c. Disconnects.
 - d. UPS.
- G. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

- H. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch high letters for emergency instructions at equipment used for power transfer.
- I. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 - 1. Labeling Instructions:
 - a. Interior Equipment: Self-adhesive, engraved, laminated acrylic or melamine label punched or drilled for stainless steel self-tapping screws. Unless otherwise indicated, provide a single line of text with 1/2-inch high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
 - b. Exterior Equipment: Self-adhesive, engraved, laminated acrylic or melamine label punched or drilled for stainless steel self-tapping screws.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
 - 2. Equipment to be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification.
 - b. Enclosures and electrical cabinets.
 - c. Transformers: Label that includes tag designation shown on Plans for the transformer, feeder, and panelboards or equipment supplied by the secondary.
 - d. Enclosed switches and disconnects.
 - e. Enclosed circuit breakers.

END OF SECTION 26 05 53

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Snap switches and wall-box dimmers.
 - 3. Wall-switch and exterior occupancy sensors.
- B. Related Sections includes the following:
 - 1. NONE

1.2 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GF or GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

1.3 SUBMITTALS

- A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.
- D. Samples: One for each type of device and wall plate specified, in each color specified.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer in accordance with Form 816 Article 1.20-1.06.01. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

1.5 COORDINATION

- A. Receptacles for Equipment furnished under other sections of the Contract Documents: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

1.6 WARRANTY

- A. Refer to Form 816 Article 1.20-1.06.08 and NOTICE TO CONTRACTOR – WARRANTIES for additional information.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Form 816 Article 1.06.03 and Form 816 Article 1.20-1.06.03 for additional information.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to the compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).
4. Or approved equal.

2.2 STRAIGHT BLADE RECEPTACLES

- A. Industrial Grade Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Available Manufacturers: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; Catalog Nos. 5251 (single), 5342 (duplex).
 - b. Hubbell.
 - c. Pass & Seymour.
 - d. Or approved equal.

- B. Industrial Grade Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Available Manufacturers: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; Catalog No. 5262 (color orange).
 - b. Hubbell.
 - c. Pass & Seymour.
 - d. Or approved equal.
2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

- B. Industrial Grade Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Available Manufacturers: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; Catalog No. GF20.
 - b. Pass & Seymour.
 - c. Hubbell
 - d. Or approved equal.
- C. Hospital-Grade, Duplex GFCI Convenience Receptacles, 125 V, 20 A (located in the second floor medical suite spaces only, see Dwg E1-223: Comply with UL 498 Supplement SD.
 1. Available Manufacturers: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; Catalog No. HGF20 (color blue).
 - b. Hubbell.
 - c. Pass & Seymour.
 - d. Or approved equal.
 2. Available Manufacturers: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; Catalog No. IG8300HG (color blue).
 - b. Hubbell.
 - c. Leviton.
 - d. Or approved equal.
- 2.4 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES
 - A. Wiring Devices for Hazardous (Classified) Locations: Comply with NEMA FB 11 and UL 1010.
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper Crouse-Hinds.
 - b. EGS/Appleton Electric.
 - c. Killark; a division of Hubbell Inc.
 - d. Or approved equal.
- 2.5 SNAP SWITCHES
 - A. Comply with NEMA WD 1 and UL 20.
 - B. Industrial Grade Switches, 120/277 V, 20 A:
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; Catalog Nos. 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
 - b. Hubbell.
 - c. Pass & Seymour.
 - d. Or approved equal.
 - C. Industrial Grade Pilot Light Switches, 20 A:
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

- a. Cooper; Catalog No. 2221PL for 120 V and 277 V.
- b. Hubbell.
- c. Pass & Seymour.
- d. Or approved equal.

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

2.6 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.
- C. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.7 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material: 0.035-inch-thick, satin-finished stainless steel.
 - 3. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in "wet locations."
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant thermoplastic with lockable cover rated for "in use" operation.

2.8 MULTIOUTLET ASSEMBLIES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Hubbell Incorporated; Wiring Device-Kellems.
 - 2. Wiremold Company (The).
 - 3. Or approved equal.
- B. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles, UL 498.
- C. Raceway Material: Metal, with manufacturer's standard finish.
- D. Wire: No. 10 AWG.

2.9 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
 - 1. Wiring Devices Connected to Normal Power System: Ivory, unless otherwise indicated or required by NFPA 70.
 - 2. Wiring Devices Connected to Emergency Power System: Ivory.
 - 3. TVSS Devices: Blue.
 - 4. Isolated-Ground Receptacles: Orange

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
 - 1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 - 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 - 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailling existing conductors is permitted provided the outlet box is large enough.
- D. Device Installation:
 - 1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 - 4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
 - 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
 - 6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
 - 7. When conductors larger than No. 12 AWG are installed on 20-A circuit, splice No. 12 AWG pigtails for device connections.
 - 8. Tighten unused terminal screws on the device.
 - 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
 - 1. Install ground pin of vertically mounted receptacles up.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions.

3.2 IDENTIFICATION

A. Comply with Division 26 Section 26 05 53 "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with white-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports in accordance with Form 816 Article 1.20-1.05.10 and as follows:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 20-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 26 27 26

SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Fusible switches.
 2. Non-fusible switches.
 3. Receptacle switches.
 4. Molded-case circuit breakers (MCCBs).
 5. Molded-case switches.
 6. Enclosures.

1.2 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 SUBMITTALS

- A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS.
- B. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 1. Enclosure types and details for types other than NEMA 250, Type 1.
 2. Current and voltage ratings.
 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 4. Include evidence of NRTL listing for series rating of installed devices.
 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
 6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Submit on translucent log-log graph paper.
- C. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
 1. Wiring Diagrams: For power, signal, and control wiring.
- D. Qualification Data: For qualified testing agency.
- E. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Plans of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

F. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

G. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Submit on translucent log-log graph paper.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer in accordance with Form 816 Article 1.20-1.06.01.

C. Product Selection for Restricted Space: Plans indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6,600 feet.

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.8 WARRANTY

- A. Refer to Form 816 Article 1.20-1.06.08 and NOTICE TO CONTRACTOR – WARRANTIES for additional information.

1.9 SPARE PARTS

- A. Furnish spare parts that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 2. Fuse Pullers: Two for each size and type.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Form 816 Article 1.06.03 and Form 816 Article 1.20-1.06.03 for additional information.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

- A. Available Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 2. Siemens Energy & Automation, Inc.
 3. Square D; a brand of Schneider Electric.
 4. Or approved equal.
- B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified and indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified and indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Accessories:
 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 5. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 6. Hookstick Handle: Allows use of a hookstick to operate the handle.
 7. Lugs: Mechanical type, suitable for number, size, and conductor material.
 8. Service-Rated Switches: Labeled for use as service equipment.
 9. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac, 24-V dc.

2.2 NONFUSIBLE SWITCHES

- A. Available Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 2. Siemens Energy & Automation, Inc.
 - 3. Square D; a brand of Schneider Electric.
 - 4. Or approved equal.
- B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 - 5. Hookstick Handle: Allows use of a hookstick to operate the handle.
 - 6. Lugs: Mechanical type, suitable for number, size, and conductor material.
 - 7. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac, 24-V dc.

2.3 RECEPTACLE SWITCHES

- A. Available Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. General Electric Company, GE Consumer & Industrial - Electrical Distribution.
 - 2. Siemens Energy & Automation, Inc.
 - 3. Square D; a brand of Schneider Electric.
 - 4. Or approved equal.
- B. Type HD, Heavy-Duty, Single-Throw Nonfusible Switch: 600-V ac, size as indicated on the Contract Plans A; UL 98 and NEMA KS 1; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- C. Interlocking Linkage: Provided between the receptacle and switch mechanism to prevent inserting or removing plug while switch is in the on position, inserting any plug other than specified and turning switch on if an incorrect plug is inserted or correct plug has not been fully inserted into the receptacle.
- D. Receptacle: Polarized, three-phase, four-wire receptacle (fourth wire connected to enclosure ground lug).

2.4 MOLDED-CASE CIRCUIT BREAKERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 2. Siemens Energy & Automation, Inc.
 3. Square D; a brand of Schneider Electric.
 4. Or approved equal.
- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
1. Instantaneous trip.
 2. Long- and short-time pickup levels.
 3. Long- and short-time time adjustments.
 4. Ground-fault pickup level, time delay, and I²t response.
- F. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- G. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
- H. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- I. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- J. Features and Accessories:
1. Standard frame sizes, trip ratings, and number of poles.
 2. Lugs: Compression type, suitable for number, size, trip ratings, and conductor material.
 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
 4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
 5. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section 26 09 13 "Electrical Power Monitoring and Control."
 6. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 7. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 8. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 9. Alarm Switch: One NO contact that operates only when circuit breaker has tripped.
 10. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be

- removable only when circuit breaker is in off position.
- 11. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
- 12. Electrical Operator: Provide remote control for on, off, and reset operations.
- 13. Accessory Control Power Voltage: integrally mounted, self-powered; 120-V ac, 24-V dc.

2.5 MOLDED-CASE SWITCHES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 2. Siemens Energy & Automation, Inc.
 - 3. Square D; a brand of Schneider Electric.
 - 4. Or approved equal.
- B. General Requirements: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating. Comply with UL 489.
- C. Features and Accessories:
 - 1. Standard frame sizes and number of poles.
 - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
 - 3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero- sequence current transformer/sensor.
 - 4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 - 5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 - 6. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.
 - 7. Alarm Switch: One NO contact that operates only when switch has tripped.
 - 8. Key Interlock Kit: Externally mounted to prohibit switch operation; key shall be removable only when switch is in off position.
 - 9. Zone-Selective Interlocking: Integral with ground-fault shunt trip unit; for interlocking ground-fault protection function.
 - 10. Electrical Operator: Provide remote control for on, off, and reset operations.
 - 11. Accessory Control Power Voltage: Integrally mounted, self-powered; 120-V ac, 24-V dc.

2.6 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, UL 489, and UL 50, to comply with environmental conditions at installed location.
 - 1. Interior, Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Exterior Locations: NEMA 250, Type 3R.
 - 3. Other Wet or Damp, Interior Locations: NEMA 250, Type 4.
 - 4. Interior Locations Subject to Dust, Falling Dirt, and Dripping Non-corrosive Liquids: NEMA 250, Type 12.
 - 5. Hazardous Areas Indicated on Plans: NEMA 250, Type 7.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Comply with mounting and anchoring requirements specified in Division 26 Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices.
- E. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Comply with requirements in Division 26 Section 26 05 53 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections in accordance with Form 816 Article 1.20-1.05.10 and as follows:
- C. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- D. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After issuance of Certificate of Compliance, but not more than 60 days after issuance of Certificate of Compliance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of issuance of Certificate of Compliance.
 - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and

malfunctioning controls and equipment.

- E. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section 26 05 73 "Overcurrent Protective Device Coordination Study".

END OF SECTION 26 28 16

SECTION 26 33 53 - STATIC UNINTERRUPTIBLE POWER SUPPLY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions of Division 1, State of Connecticut, Department of Transportation, Standard Specifications for Roads, Bridges, and Incidental Construction, Form 816 - 2004 and supplemental specifications thereto, shall be a part of this specification.

1.2 SUMMARY

- A. Section includes the furnishing and installation of a static uninterruptible power supply system for the purpose of providing emergency lighting.

1.3 REFERENCES

- A. Institute of Electrical and Electronics Engineers:
 - 1. IEEE 1184 - Guide for the Selection and Sizing of Batteries for Uninterruptible Power Systems.
- B. National Electrical Manufacturers Association:
 - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2. NEMA PE 1 - Uninterruptible Power Systems.
- C. International Electrical Testing Association:
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.4 SUBMITTALS

- A. Submit the following in accordance with Form 816, Section 1.20 and NOTICE TO CONTRACTOR-SUBMITTALS.
- B. Shop Drawings: Indicate electrical characteristics and connection requirements. Indicate battery rack dimensions; battery type, size, dimensions, and weight; detailed equipment outlines, weight, and dimensions; location of conduit entry and exit; single-line diagram indicating metering, control, and external wiring requirements; heat rejection and air flow requirements.
- C. Product Data: Submit catalog sheets and technical data sheets to indicate physical data and electrical performance, electrical characteristics, and connection requirements.
- D. Manufacturer's Field Reports: Indicate inspections, findings, and recommendations.
- E. Quality assurance submittals:

1. Manufacturer's certification letter in accordance with NOTICE TO CONTRACTOR POTENTIAL FOR ASBESTOS CONTAINING MATERIALS.
2. Seismic qualifications certificates.
3. Field quality control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS.
- B. Operation and Maintenance Data: Submit description of operating procedures; servicing procedures; list of major components; recommended remedial and preventive maintenance procedures; and spare parts list.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain products from a single manufacturer in accordance with Form 816 Article 1.20-1.06.01
- B. Source limitations: Obtain the UPS system from a single manufacturer in accordance with the requirements of Form 816 article 1.20-1.05.24. Manufacturer: Company specializing in manufacturing products specified in this section with minimum twenty years of documented experience.
- C. Conduct and pre-installation meeting at the project site.
- D. Testing agency qualifications: Member of NETA or and NRTL.
- E. Comply with the requirements of the following standards:
 1. CSA Listing C22.2 No107.1-95, UL 1778, UL924/A- Underwriters Laboratories Inc. standard for UPS systems and rectifying equipment and specialty transformers.
 2. IEEE C62.41-1991- IEEE Recommended Practice on Surge Voltages in Low-voltage AC Power Circuits
 3. ANSI NFPA 70-National Electrical Code.
 4. UL50 and NEMA 250-1991- Enclosures for electrical Equipment
 5. CSA C22.1-94_Canadian Electrical Code, Part I
 6. UL1449_UL Standard for Safety Transient Voltage Surge Suppressors.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Form 816 Article 1.06.03 and Form 816 Article 1.20-1.06.03 for additional information.
- B. Comply with Form 816 Article 1.06.03 and Form 816 Article 1.20-1.06.03 for additional information.
- C. Protect equipment from extreme temperature and humidity by storing in conditioned space.
- D. Protect equipment from dust and debris by wrapping unit in dust tight cover and storing away from construction activity.

1.8 WARRANTY

- A. Refer to Form 816 Article 1.20-1.06.08 and NOTICE TO CONTRACTOR – CLOSEOUT DOCUMENTS for additional information.
- B. Furnish one year manufacturer warranty for parts and labor.

PART 2 PRODUCTS

2.1 SCOPE:

- A. The UPS shall be a solid-state single phase UPS system designed to provide regulated and conditioned sinusoidal power to both linear and non-linear type loads. The UPS shall provide uninterruptible power during all modes of operation. There shall be no interruption of power to the critical load when the UPS transfer to and from battery operation. The specified equipment herein shall be referred to as Harsh Environment UPS or HE UPS.
- B. The UPS and batteries shall be designed to fit into a NEMA 3R enclosure intended for outdoor installations. It shall be of modular construction for ease of servicing in the field.
- C. The primary input power source to the UPS shall be utility power.

2.2 MODES OF OPERATION

- A. **NORMAL:** During normal operation, utility power is converted to DC, drawing sinusoidal input AC current at utility power factor under all load conditions, this converter supplies DC power to the Inverter and Battery Charger sections. The inverter supplied the load through the Static Bypass Switch without using the energy stored in the battery.
- B. **EMERGENCY:** Upon loss of input power or when power exceeds the specified input limits, the control logic shall allow the inverter to draw energy from the battery without interruption to the load and disconnect the input line. The transfer to battery shall be uninterrupted-“NO BREAK” power transfer. The inverter shall supply power from the batteries, through the Static Bypass Switch, to the critical load. The output shall be sinusoidal and within specified limits.
- C. **FAILURE:** In the event of a component failure in either the Rectifier/Converter or the Inverter the unit’s SBS will transfer the load, without interruption to the utility power and will alarm providing visual and closed contacts for remote annunciation.
- D. **RECHARGE:** Upon restoration of input utility power and before the batteries are completely exhausted, the UPS shall automatically return to normal operation. This retransfer to normal operation shall be uninterrupted. The battery charger shall automatically recharge the batteries to full capacity.

2.3 MAJOR SYSTEM COMPONENTS:

- A. The UPS and batteries shall be designed to fit into NEMA 3R enclosure intended for outdoor installation.
- B. The NEMA 3R cabinet is made of stainless steel ensuring suitability for outdoor harsh environments.
- C. **BATTERY SUBSYSTEM:** Sealed, maintenance-free batteries shall be provided. The batteries shall have an expected life of ten(10) years. The batteries shall be fully wired and contained within either the UPS cabinet or a separate battery cabinet. Battery run time (based on 100%) full load) shall be no less than the specified time. Optional extended battery run times shall be available.
- D. **INVERTER:** The inverter shall convert power supplied, from the utility, when within specified limits or from the batteries, when within the battery manufacturer’s specified limits, to AC power. It should be a pulse width modulation(PWM) type design without the need of a transformer. The unit shall have a single power PCB for maximum reliability.

- E. STATIC BYPASS SWITCH: The unit shall contain a static Bypass Switch as a standard feature.
- F. CHARGER: The battery charger shall maintain the batteries at full charge. The standard battery charger shall recharge the battery in 10 times the discharge time maximum.
- G. POWER CONNECTIONS: The UPS shall be hard wired input and output.
- H. SYSTEM OPTIONS:
 - 1. Provide the system with the following options:
 - a. Internal manual maintenance bypass switch
 - b. Five(5) form "c" contacts alarms
 - c. Heater strip with thermostat control
 - d. TVSS
 - e. Computer monitoring via RS 232.
 - f. Stainless Steel Cabinet for UPS and battery

2.4 INPUT SPECIFICATIONS

- A. System Ratings and Operating Characteristics:
 - 1. System Continuous Rating: As indicated on Drawings, over entire battery voltage range at specified power factor. Maintain output voltage within specified limits at load from full load to no-load.
 - 2. Battery Capacity: As indicated on drawings.
 - 3. Voltage Rating: 120/208 volts, 3 phase, 4wire.
 - 4. Input Voltage Operating Range: Plus or minus 3 percent.
 - 5. Input Frequency Operating Range: 60 Hz, plus or minus 0.5 Hz.
 - 6. Input Current Limit: Adjustable to maximum of 125 percent required to operate at full load with battery bank on float charge.
 - 7. Current Walk-in: 25 to 100 percent in fifteen seconds.
 - 8. UPS Power Factor Over Full Range of Loads and Input Voltages: 95 percent, lagging.
 - 9. Harmonic Distortion of Input Current Wave Form: 5 percent maximum at full load.
 - 10. Output Free Running Frequency: 60 Hz Plus or minus 0.5 percent.
 - 11. Output Harmonic Distortion: Maximum 5 percent rms total harmonic distortion (THD) and maximum 3 percent any single harmonic, at rated frequency and voltage, from 10 percent load to full load and over battery voltage range, measured into linear load.
 - 12. Voltage Transient Response for Application of 0 to 50 Percent, 50 to 100 Percent, 100 to 50 Percent, and 50 to 0 Percent Step Loads, and Transfer To and From Bypass Line:
 - a. Plus 8, minus 10 percent for maximum of 8.3 milliseconds.
 - b. Plus or minus 5 percent for maximum of 25 milliseconds.
 - c. Plus or minus 3 percent for maximum of 50 milliseconds.
 - 13. Phase Displacement:
 - a. 120 plus or minus 1 degrees for balanced loads.
 - b. 120 plus or minus 4 degrees for 50 percent unbalanced loads.
 - 14. Three-phase Overload Ratings:
 - a. 1000 percent for 5 cycles; via static switch.
 - b. 150 percent for 10 seconds.

- c. 125 percent for 10 minutes.
- 15. Output Current Limit: 150 percent of rated output current.
- 16. Voltage Unbalance: 3 percent maximum line-line with 100 percent load unbalance.
- 17. Efficiency: 92 percent at full load.
- 18. Standard Run time: 7~12 minutes(Unit dependent)
- 19. Optional run time: 180 minutes
- 20. Battery type: Sealed, Maintenance free, lead acid.
- 21. Expected life: 10 years.
- 22. Protection: Circuit Breaker.

2.5 MONITORING AND COMMUNICATION

- A. Computer Communications
 - 1. RS-232 Interface Port
 - 2. RS-485 Interface Port
- B. Agency Listings:
 - 1. UL 1778, CSA Listed to UL924/A for outdoor application
- C. Surge Withstand ability: ANSI C62.41-1980 Categories A & B.
- D. Temperature:
 - 1. 0~40°C (Operating)
 - 2. -20~40°C (Storage)
- E. Relative Humidity: 0 to 95% Non-condensing

2.6 MANUFACTURERS:

- A. On Line ETERNALIGHT Plus Power
- B. Crucial Power Products
- C. Liebert

2.7 FABRICATION

- A. All materials and components making up the UPS shall be new, of current manufacturer, and shall not have been in prior service except as required during factory testing. The UPS shall be constructed of replaceable subassemblies. All active electronic devices shall be solid state.
- B. Wiring: Wiring practices, and cooling shall be in accordance with the requirements of National Electrical Code(NFPA 70) and other applicable codes and standards.
- C. Cabinet: The UPS unit shall comprised of: power module, battery module, control module, system interconnect module and user interface module housed in a single freestanding enclosure and meets the requirements if IP20. The UPS cabinet shall be stainless steel to meet the NEMA 3R requirements.
- D. Cooling: The UPS and battery cabinets shall be forced air cooled by internally mounted fans. The fans shall be redundant in nature to ensure maximum reliability. The fans shall be easily replaceable without the use of special tools.

2.8 COMPONENTS

- A. Input Converter:
 - 1. General: Incoming AC power shall be converted to a regulated DC output by the input converter for supplying DC power to the inverter. The input converter shall provide input power factor correction to 0.95 or greater regardless of the nature

of the load and input current shall be sinusoidal with less than 7% total harmonic distortion regardless of load.

2. AC Input current limit: The input converter shall be provided with AC input over current protection. The unit has the input circuit breaker.
3. Input protection: The UPS shall have built-in protection against under voltage, over current, and over voltage conditions including low energy surges introduced on the primary AC source and the bypass source. The UPS cabinet shall contain an input breaker sized to supply full rated load and to recharge the battery at the same time.
4. Input converter: Input converter shall automatically monitor and correct the input current to be sinusoidal with power factor correction.
5. Battery recharge: To prolong battery life, the UPS shall contain battery charging. When an equal number of power modules and battery modules are fitted the battery charger shall be able to recharge the internal batteries to 90% charge in less than ten hours at normal input voltage and normal ambient temperature.

B. Inverter:

1. General: The inverter shall convert DC power from the input converter output, or the battery, into precise regulated sine wave AC power for supporting the critical AC load.
2. Overload: The inverter shall be capable of supplying current and voltage for overloads exceeding 100% and up to 125% of full load current. A visual indicator/alarm shall indicate overload operation. For greater currents or longer time duration, the inverter shall have electronic current-limiting protection to prevent damage to components. The inverter shall be self-protecting against any magnitude of connected output overload. Inverter control logic shall sense and disconnect the inverter from the critical AC load without the requirement to clear protective fuses. The load shall be transferred to bypass when any of the above conditions are exceeded.
3. Maximum load alarm: The user receives an alarm when the unit is overloaded (greater than 100%) such that the UPS will alarm before an overload condition.
4. Output frequency: A microprocessor-controlled oscillator shall maintain the output frequency of the inverter. The oscillator shall hold the inverter output frequency to $\pm 0.5\%$ for steady state and transient conditions. The inverter shall track the bypass continuously providing the bypass source maintains a frequency within the user selected synchronization range. If the bypass source fails to remain within the selected range, the inverter shall revert to the internal oscillator.
5. Output protection: The UPS inverter shall employ electronic current limiting.
6. Battery over discharge protection: To prevent battery damage from over discharging, the UPS control logic shall control the shutdown voltage set point. This point is dependent on the levels set by the manufacturer of particular battery system employed.

C. Display and controls

1. General: An internal panel will consist of a four line by twenty-character LCD display for additional alarm/configuration. The unit shall also provide data via RS232/RS485. If there is a fault condition, the UPS shall attempt to maintain conditioned power to the load, or at minimum transfer bypass. There shall also be

D. Automatic battery test:

1. The UPS shall initiate an automatic battery testing periodically, at a programmed day and time of day.

E. Bypass:

1. General: A bypass circuit shall be provided as an internal part of the UPS. The bypass shall have an overload rating of 300% rated full load for 10 cycles and 1000% for sub-cycle fault clearing. The bypass control logic shall contain an automatic transfer control circuit that senses the status of the inverter logic signals, and operating and alarm conditions. This control circuit shall provide a transfer of the load to the bypass source, without exceeding the transient limits specified herein, when an overload or malfunction occurs within the UPS.
2. Automatic transfers: The transfer control logic shall automatically activate the bypass, transferring the critical AC load to the bypass source, after the transfer logic senses one of the following conditions:
 - a. Inverter overload capacity exceeded
 - b. Inverter over temperature
 - c. UPS fault condition
3. For inverter overload conditions, the transfer control logic shall inhibit an automatic transfer of the critical load to the bypass source if one of the following conditions exists:
 - a. Inverter/Bypass voltage difference exceeding preset limits ($\pm 15\%$ of nominal)
 - b. Bypass frequency out of preset limits ($\pm 5\%$ of nominal frequency)
 - c. UPS fault condition present.

F. Internal battery:

1. General: Flame retardant, valve regulated, gas recombination, lead acid batteries shall be used as a stored-energy source for the specified UPS system.

2.9 COMMUNICATIONS

- A. General: The UPS shall allow for flexibility in communications. The UPS shall be able to communicate through two communications ports simultaneously; the media of either communications port may change without affecting the operation of the UPS. The use of relay contacts shall not affect the operation of the two communications ports.
- B. Relay contacts: The relay contacts shall be available through at least one DB-9F communication connector, and shall be compatible with the AS 400 system. The UPS shall communicate via relay contact closure the following information: Low battery, on bypass, summary alarm, UPS on and input fail. One connector to provide relay contacts shall be fitted on all UPS models as standard. Relay contacts shall be rated 48VDC, 1A. Additional signals such as on bypass and summary alarm shall be provided.
- C. UPS status information: The software shall be able to retrieve all status information present in the UPS (and available on the display). Retrieval of data shall be through either serial communications or through a network connection via RS 232/RS485.
- D. Furnish shop inspection and testing of components and completed UPS assembly.
- E. Make completed UPS available for inspection at manufacturer's factory prior to packaging for shipment. Notify Owner at least seven days before inspection is allowed.
- F. Allow witnessing of factory inspections and tests at manufacturer's test facility. Notify Owner at least seven days before inspections and tests are scheduled.

PART 3 EXECUTION**3.1 FIELD QUALITY CONTROL**

- A. Factory trained field service personnel shall perform the following inspections and test procedures during the UPS start-up.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.22.
- D. Verify specification performance criteria.
- E. Measure battery discharge and recharge times.
- F. Simulate fault in each system component and utility power.
- G. Operate unit at 77 degrees F (25 degrees C) for eight hours.
- H. Perform other tests as recommended by manufacturer.

3.2 MANUFACTURER'S FIELD SERVICES

- A. Quality Requirements: Manufacturer's field services.
- B. Prepare and start up UPS.

3.3 ADJUSTING

- A. Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Adjust output voltage to within 1 percent of nominal.
- C. Adjust output frequency to within 0.6 percent of nominal.

END OF SECTION 26 33 53

SECTION 27 05 00 - COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 1. Communications equipment coordination and installation.
 2. Sleeves for pathways and cables.
 3. Sleeve seals.
 4. Grout.
 5. Common communications installation requirements.

1.2 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.3 SUBMITTALS

- A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS.
 1. Product Data: For sleeve seals.

1.4 COORDINATION

- A. Coordinate arrangement, mounting, and support of communications equipment:
 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 3. To allow right of way for piping and conduit installed at required slope.
 4. So connecting pathways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed.
- D. Coordinate sleeve selection and application with selection and application of firestopping.

1.5 WARRANTY

- A. Refer to Form 816 Article 1.20-1.06.08 and NOTICE TO CONTRACTOR – WARRANTIES for additional information.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Form 816 Article 1.06.03 and Form 816 Article 1.20-1.06.03 for additional information.

PART 2 - PRODUCTS

2.1 SLEEVES FOR PATHWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. Calpico, Inc.
 - 3. Metraflex Co.
 - 4. Pipeline Seal and Insulator, Inc.
 - 5. Or Approved equal.
- C. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of pathway or cable.
- D. Pressure Plates: Include two for each sealing element.
- E. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION

- A. Comply with the latest version of NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Communications penetrations occur when pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 6 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and pathway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry.
- I. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section 07 92 00 "Joint Sealants".
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable penetration sleeves with firestop materials.
- L. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between pathway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly.

END OF SECTION 27 05 00

SECTION 27 51 16 - PUBLIC ADDRESS AND MASS NOTIFICATION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. The work of this section provides for the furnishing and installation of speakers, ambient noise microphone/sensors, raceway and cabling in the areas indicated, as well as providing infrastructure, space and fit up in the communications/IT rooms for paging equipment to be provided and installed by MNR.
- B. Speaker types and locations are generally shown in the required spaces on the Contract Drawings. The Contractor shall further refine placement within these locations using an acoustical designer to determine final locations and placement of speaker units to optimize system performance and avoid nuisance echoing and reverberation, especially in open shop floor areas. Final locations and placement of speaker units, based upon evaluation of the Contractor's acoustical designer, shall be submitted for review and approval, prior to installation.
- C. Work also includes field testing for installed sound measurement levels for speaker systems to calibrate and determine optimum signals levels for areas indicated with speakers on the Contract Drawings. Testing shall be conducted by the acoustical designer utilized by the Contractor that determined the final placement of speaker units. Test results and calibrations performed on equipment to optimize signal levels shall be tabulated and presented in a report to be submitted for approval.
- D. Section Includes:
 - 1. Loudspeakers.
 - 2. Ambient noise microphones/sensors
 - 3. Conductors and cables.
 - 4. Raceways.
- E. Speaker and types for the platform and on the extension part of the pedestrian bridge shall be same as those existing.

1.2 DEFINITIONS

- A. Channels: Separate parallel signal paths, from sources to loudspeakers or loudspeaker zones, with separate amplification and switching that permit selection between paths for speaker alternative program signals.
- B. VU: Volume unit.
- C. Zone: Separate group of loudspeakers and associated supply wiring that may be arranged for selective switching between different channels.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports and seismic restraints for control consoles, equipment cabinets and racks, and components, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Seismic Performance: Supports and seismic restraints for control consoles, equipment cabinets and racks, and components shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event".

1.4 SUBMITTALS

- A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: For supports and seismic restraints for control consoles, equipment cabinets and racks, and components. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Console layouts.
 - 3. Control panels.
 - 4. Rack arrangements.
 - 5. Calculations: For sizing backup battery.
 - 6. Wiring Diagrams: For power, signal, and control wiring.
 - a. Identify terminals to facilitate installation, operation, and maintenance.
 - b. Single-line diagram showing interconnection of components.
 - c. Cabling diagram showing cable routing.
- D. Final Speaker Placement Locations: Submit for approval final locations and placement of speaker units to optimize system performance and avoid nuisance echoing and reverberation, especially in open shop floor areas. Submittal format shall consist of speaker locations and types used shown on full size floor plan drawings.
- E. Delegated-Design Submittal: For supports and seismic restraints for control consoles, equipment cabinets and racks, and components indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of supports and seismic restraints for control consoles, equipment cabinets and racks, and components.
- F. Coordination Plans: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings are shown and coordinated with each other, using input from installers of the items involved.
- G. Qualification Data: For qualified Installer and testing agency.
- H. Seismic Qualification Certificates: For control consoles, equipment cabinets and racks, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Plans of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- I. Field quality-control reports.
 - J. Field test report for installed sound measurement levels for speaker systems. Report shall include sound level test results and calibrations performed on equipment to optimize signal levels.
 - K. Operation and Maintenance Data: For public address and mass notification systems to include in emergency, operation, and maintenance manuals.
- 1.5 QUALITY ASSURANCE
- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
 1. Personnel certified by NICET as Audio Systems Level II Technician.
 - B. Testing Agency Qualifications: Qualified agency, with the experience and capability to conduct testing indicated.
 1. Testing Agency's Field Supervisor: Currently certified by NICET at Level III to supervise on-site testing.
 - C. Source Limitations: Obtain public address and mass notification systems from single source from single manufacturer.
 - D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - E. Comply with NFPA 70.
- 1.6 COORDINATION
- A. Coordinate layout and installation of system components and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
- 1.7 SPARE PARTS
- A. Furnish spare parts that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Speaker: One of each type.
- 1.8 WARRANTY
- A. Refer to Form 816 Article 1.20-1.06.08 and NOTICE TO CONTRACTOR – WARRANTIES for additional information.
- 1.9 DELIVERY, STORAGE, AND HANDLING
- A. Refer to Form 816 Article 1.06.03 and Form 816 Article 1.20-1.06.03 for additional information.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Alpha Communications.
2. Altec Lansing Technologies, Inc.
3. Atlas Sound LP.
4. Bogen Communications, Inc.
5. Dukane Communication Systems; part of GE Infrastructure, Security.
6. Edwards Signaling & Security Systems; part of GE Infrastructure, Security.
7. Electro-Voice; Telex Communications, Inc.
8. Federal Signal Corporation; Electrical Products Division.
9. Peavey Electronics.
10. Rauland-Borg Corporation.
11. Whelen Engineering Company, Inc.
12. Or approved equal.

2.2 FUNCTIONAL DESCRIPTION OF SYSTEM

- A. System Functions (Head end equipment to be provided and installed by MNR):

1. Selectively connect any zone to any available signal channel.
2. Selectively control sound from microphone outlets and other inputs.
3. "All-call" feature shall connect the all-call sound signal simultaneously to all zones regardless of zone or channel switch settings.
4. Telephone paging adapter shall allow paging by dialing an extension from any local telephone instrument and speaking into the telephone.
5. Produce a program-signal tone that is amplified and sounded over all speakers, overriding signals currently being distributed.
6. Reproduce high-quality sound that is free of noise and distortion at all loudspeakers at all times during equipment operation including standby mode with inputs off; output free of non-uniform coverage of amplified sound.

2.3 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS

- A. Compatibility of Components: Coordinate component features to form an integrated system. Match components and interconnections for optimum performance of specified functions.
- B. Equipment: Comply with UL 813. Equipment shall be modular, using solid-state components, and fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.
- C. Equipment Mounting: Where rack, cabinet, or console mounting is indicated, equipment shall be designed to mount in a 19-inch housing complying with TIA/EIA-310-D.
- D. Weather-Resistant Equipment: Listed and labeled by a qualified testing agency for duty outdoors or in damp locations.

2.4 EQUIPMENT CABINET

- A. Comply with TIA/EIA-310-D.
- B. House amplifiers and auxiliary equipment at each location.
- C. Cabinet Housing:
1. Constructed of 0.0478-inch steel, minimum, with front- and rear-locking doors and standard TIA/EIA-310-D-compliant, 19-inch racks.
 2. Arranged for floor or wall mounting as indicated.

3. Sized to house all equipment indicated, plus spare capacity.
 4. Include 20 percent minimum spare capacity for future equipment in addition to space required for future cassette deck and CD player.
- D. Power Provisions: A single switch in cabinet shall disconnect cabinet power distribution system and electrical outlets, which shall be uniformly spaced to accommodate ac-power cords for each item of equipment.
- E. Ventilation: A low-noise fan for forced-air cabinet ventilation. Fan shall be equipped with a filtered input vent and shall be connected to operate from 105- to 130-V ac, 60 Hz; separately fused and switched; arranged to be powered when main cabinet power switch is on.

2.5 EQUIPMENT RACK

- A. Racks: 19 inches standard, complying with TIA/EIA-310-D.
- B. Power-Supply Connections: Compatible plugs and receptacles.
- C. Enclosure Panels: Ventilated rear and sides and solid top. Use louvers in panels to ensure adequate ventilation.
- D. Finish: Uniform, baked-enamel factory finish over rust-inhibiting primer.
- E. Power-Control Panel: On front of equipment housing, with master power on-off switch and pilot light; and with socket for 5-A cartridge fuse for rack equipment power.
- F. Service Light: At top rear of rack with an adjacent control switch.
- G. Vertical Plug Strip: Grounded receptacles, 12 inches o.c.; the full height of rack.
- H. Maintenance Receptacles: Duplex convenience outlets supplied independent of vertical plug strip and located in front and bottom rear of rack.
- I. Spare Capacity: 20 percent in rack for future equipment.

2.6 LOUDSPEAKERS

- A. Cone-Type Loudspeakers:
 1. Minimum Axial Sensitivity: 91 dB at one meter, with 1-W input.
 2. Frequency Response: Within plus or minus 3 dB from 50 to 15,000 Hz.
 3. Size: 8 inches with 1-inch voice coil and minimum 5-oz. ceramic magnet.
 4. Minimum Dispersion Angle: 100 degrees.
 5. Rated Output Level: 10 W.
 6. Matching Transformer: Full-power rated with four taps. Maximum insertion loss of 0.5 dB.
 7. Surface-Mounting Units: Ceiling, wall, or pendant mounting, as indicated, in steel back boxes, acoustically dampened. Front face of at least 0.0478-inch steel and whole assembly rust proofed and shop primed for field painting.
 8. Flush-Ceiling-Mounting Units: In steel back boxes, acoustically dampened. Metal ceiling grille with white baked enamel.
- B. Horn-Type Loudspeakers:
 1. Type: Single-horn units, double-reentrant design, with minimum full-range power rating of 15 W.
 2. Matching Transformer: Full-power rated with four standard taps. Maximum insertion loss of 0.5 dB.

3. Frequency Response: Within plus or minus 3 dB from 250 to 12,000 Hz.
4. Dispersion Angle: 130 by 110 degrees.
5. Mounting: Integral bracket.
6. Units in Hazardous (Classified) Locations: Listed and labeled for environment in which they are located.

2.7 OUTLETS

- A. Volume Attenuator Stations for use in office space areas: Wall-plate-mounted autotransformer type with paging priority feature.
 1. Wattage Rating: 10 W unless otherwise indicated.
 2. Attenuation per Step: 3 dB, with positive off position.
 3. Insertion Loss: 0.4 dB maximum.
 4. Attenuation Bypass Relay: Single pole, double throw. Connected to operate and bypass attenuation when all-call, paging, program signal, or prerecorded message features are used. Relay returns to normal position at end of priority transmission.
 5. Label: "PA Volume".
- B. Ambient Noise Microphone/Sensor: Control module shall be Bogen model ANS501 or approved equal. Microphone module shall be Bogen ANS500M or approved equal with 12 V/0.4 A wall mounted power supply.
 1. System shall electronically adjust level of page announcement in an area where ambient noise levels are continuously changing.
 2. System shall continuously monitor ambient noise level through microphone modules located in maintenance shop floor areas and change page signal level to make pages audible over the noise.
 3. Control module shall include controls for maximum boost, activity threshold, relative gain; AUX input level, ramp speed and ambient MIC input threshold. Module shall also be provided with mode switch and status LEDS.
 4. System shall be powered by 12V power supply, supplied by 120VAC with 400 mA draw maximum.

2.8 BATTERY BACKUP POWER UNIT

- A. Unit shall be rack mounted, consisting of time-delay relay, sealed lead-calcium battery, battery charger, on-off switch, "normal" and "emergency" indicating lights, and adequate capacity to supply maximum equipment power requirements for one hour of continuous full operation.
- B. Unit shall supply public address equipment with 12- to 15-V dc power automatically during an outage of normal 120-V ac power.
- C. Battery shall be on float charge when not supplying system and to transfer automatically to supply system after three to five seconds of continuous outage of normal power, as sensed by time-delay relay.
- D. Unit shall automatically retransfer system to normal supply when normal power has been reestablished for three to five seconds continuously.

2.9 CONDUCTORS AND CABLES

- A. Jacketed, twisted pair and twisted multipair, untinned solid copper.
 1. Insulation for Wire in Conduit: Thermoplastic, not less than 1/32 inch thick.

2. Microphone Cables: Neoprene jacketed, not less than 2/64 inch thick, over shield with filled interstices. Shield No. 34 AWG, tinned, soft-copper strands formed into a braid or approved equivalent foil. Shielding coverage on conductors is not less than 60 percent.
3. Plenum Cable: Listed and labeled for plenum installation.

2.10 RACEWAYS

- A. Conduit and Boxes: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.

1. Outlet boxes shall be not less than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

PART 3 - EXECUTION

3.1 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems".
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF RACEWAYS

- A. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.
- B. Install manufactured conduit sweeps and long-radius elbows whenever possible.

3.3 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Cable Installation Requirements:
 1. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
 2. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
 3. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
 5. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 6. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.

C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend speaker cable not in a wireway or pathway a minimum of 8 inches above ceiling by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.

D. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.

3.4 INSTALLATION

A. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

B. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.

C. Equipment Cabinets and Racks:

1. Group items of same function together, either vertically or side by side, and arrange controls symmetrically. Mount monitor panel above the amplifiers.
2. Arrange all inputs, outputs, interconnections, and test points so they are accessible at rear of rack for maintenance and testing, with each item removable from rack without disturbing other items or connections.
3. Blank Panels: Cover empty space in equipment racks so entire front of rack is occupied by panels.

D. Wall-Mounted Volume Attenuator Station Outlets: Flush mounted at each private office space and open floor office spaces.

E. Floor-Mounted Outlets: Conceal in floor and install cable nozzles through outlet covers. Secure outlet covers in place. Trim with carpet in carpeted areas.

F. Conductor Sizing: Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than No. 18 AWG and conductors from microphone receptacles to amplifiers not smaller than No. 22 AWG.

G. Weatherproof Equipment: For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.

H. Speaker-Line Matching Transformer Connections: Make initial connections using tap settings indicated on Plans.

I. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables".

J. Ambient Noise Microphones/sensors: Four (4) microphone modules shall be installed in the maintenance shop track area, one in each quadrant of the rectangular area comprised of tracks 94, 95 and 96, wall mounted approximately 10'-0" AFF using vendor provided adjustable mounting

bracket for precise positioning. The control module shall be located in main COMM/IT room 278, mounted on the paging equipment backboard.

3.5 GROUNDING

- A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.
- C. Install grounding electrodes as specified in Division 26 Section "Grounding and Bonding for Electrical Systems".

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections in accordance with Form 816 Article 1.20-1.05.10 and as follows:
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
 - 1. Schedule tests with at least seven days' advance notice of test performance.
 - 2. After installing public address and mass notification systems and after electrical circuitry has been energized, test for compliance with requirements.
 - 3. Operational Test: Perform tests that include originating program and page messages at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and that system is free of noise and distortion.
 - 4. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:
 - a. Disconnect microphone at connector or jack closest to it and replace it in the circuit with a signal generator using a 1000-Hz signal. Replace all other microphones at corresponding connectors with dummy loads, each equal in impedance to microphone it replaces. Measure signal-to-noise ratio.
 - b. Repeat test for each separately controlled zone of loudspeakers.
 - c. Minimum acceptance ratio is 50 dB.
 - 5. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 50, 200, 400, 1000, 3000, 8000, and 12,000 Hz into each preamplifier channel. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 3 percent total harmonics.
 - 6. Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each zone. For spaces with seated audiences, maximum permissible variation in level is plus or minus 2 dB. In addition, the levels between locations in same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.

7. Power Output Test: Measure electrical power output of each power amplifier at normal gain settings of 50, 1000, and 12,000 Hz. Maximum variation in power output at these frequencies must not exceed plus or minus 1 dB.
 8. Signal Ground Test: Measure and report ground resistance at public address equipment signal ground. Comply with testing requirements specified in Division 26 Section "Grounding and Bonding for Electrical Systems".
 9. Installed sound measurement level field testing for speaker systems: Test to determine installed speaker system sound levels and calibrate to optimum signals levels to deliver page announcements that are audible over normal ambient sound level for the various areas. Testing shall be conducted by the acoustical designer utilized by the Contractor for determining the final placement of speaker units.
- E. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.
 - F. Public address and mass notification systems will be considered defective if they do not pass tests and inspections.
 - G. Prepare test and inspection reports.
 1. Include a record of final speaker-line matching transformer-tap settings, and signal ground-resistance measurement certified by Installer.
- 3.7 STARTUP SERVICE
- A. Engage a factory-authorized service representative to perform startup service.
 1. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.
 2. Complete installation and startup checks according to manufacturer's written instructions.
- 3.8 ADJUSTING
- A. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.
 - B. Occupancy Adjustments: When requested within 12 months of date of Issuance of Certificate of Compliance, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
- 3.9 DEMONSTRATION
- A. Refer to Form 816 Article 1.20-1.08.14 subsection 3 for additional information.
 - B. Engage a factory-authorized service representative to train Department's maintenance personnel to adjust, operate, and maintain the public address and mass notification systems and equipment.

END OF SECTION 27 51 16

SECTION 34 82 05 - ELASTOMERIC BEARING PADS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work under this item shall consist of furnishing and installing elastomeric bearing pads and all other necessary materials and equipment to complete the work as shown on the plans.

1.2 SUBMITTALS

- A. **Shop Drawings:** Before fabricating any materials, the Contractor shall submit shop drawings to the Engineer, for review and approval, in accordance with CTDOT Form 816 Subarticle 1.05.02-3, and the NOTICE TO CONTRACTOR – SUBMITTALS. These drawings shall include, but not be limited to, the following information: The name of manufacturer, complete details of the pads, and pertinent material designations.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. **Elastomeric Bearing Pads:** Elastomeric bearing pads shall conform to the requirements of CTDOT Form 816 Article M.17.01.

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS

- A. **Setting the Bearing Pads:** The Contractor shall set the elastomeric bearing pads in accordance with the following requirements for concrete bearing areas: The bearing areas of the masonry upon which the elastomeric bearing pads are to rest shall be carefully finished, by grinding if necessary, to a smooth, even level surface of the required elevation, and shall show no variations from a true plane greater than 1/16 inch (1.5 millimeter) over the entire area upon which the elastomeric bearing pads are to rest.

END OF SECTION 34 82 05

SECTION 34 82 10 – STEEL LAMINATED ELASTOMERIC BEARINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work under this item shall consist of furnishing and installing steel-laminated elastomeric bearings as shown on the plans, as directed by the Engineer and in accordance with these specifications.

1.2 SUBMITTALS

- A. **Shop Drawings:** Before fabricating any materials, the Contractor shall submit shop drawings to the Engineer, for review and approval, in accordance with CTDOT Form 816 Subarticle 1.05.02, and the NOTICE TO CONTRACTOR – SUBMITTALS. These drawings shall include, but not be limited to, the following information: manufacturers name, complete details of the bearings, material designations, nominal hardness of the elastomer, the quantity of bearings required, including test bearings, and the location of the bearing identification.
- B. **Certification:** The Contractor shall furnish a Certified Test Report, confirming that the elastomeric bearings satisfy the requirements of these specifications, in conformance with the requirements set forth in CTDOT Form 816 Article 1.06.07.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. **Elastomer:** The elastomeric compound, used in the construction of the bearings, shall contain only virgin polychloroprene (Neoprene) as the raw polymer. The elastomer compound shall be low temperature grade 3 (as defined by the testing requirements), have a Shore "A" Durometer hardness as shown on the plans and meet the requirements of the AASHTO Standard Specifications for Highway Bridges, Division II - Construction.
- B. **Steel Laminates:** The internal steel laminates, used for reinforcement, shall be a mild rolled steel conforming to AASHTO M 270 Grade 250, or an approved equal.
- C. **External Load Plates & Connection Plates:** The external load plates and connection plates shall conform to the requirements shown on the plans.
 - 1. All surfaces of the external load plates and connection plates shall be abrasive blast cleaned prior to being hot bonded to the bearing during vulcanization. For bearings used on painted steel structures, the surfaces of the external load plates and connection plates shall be prepared in accordance with the requirements of the special provision "Structural Steel" contained elsewhere within these specifications. For bearings used on

weathering steel structures, the surfaces of the external load plates and connection plates shall be blast cleaned in accordance with the requirements of SSPC-SP6 "Commercial Blast Cleaning".

2. After fabrication, the external load plates and connection plates of bearings used on painted steel structures shall be shop painted in accordance with the requirements of the special provision "Structural Steel" contained elsewhere within these specifications.
3. Adhesive bonding of the elastomer portion of the bearings to the external load plates and connection plates is not permitted.

D. **Cap Screws:** Cap screws shall be stainless steel.

E. **Sealant:** Silicone joint sealant shall conform to the requirements of CTDOT Form 816 Section M.03.08. Structural Steel: All structural steel shall be galvanized and of the type and grade designated on the plans.

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS

A. **Fabrication and Fabrication Tolerances:** The fabrication and fabrication tolerances of elastomeric bearings shall conform to the requirements of the AASHTO Standard Specifications for Highway Bridges, Division II - Construction.

1. If guide pins or other devices are used to control the side cover over the steel laminates, any exposed portions of the steel laminates shall be sealed by vulcanized patching.

B. **Testing:** The materials for the elastomeric bearing and the finished bearings themselves shall be subjected to testing. The testing shall conform to the requirements of the AASHTO Standard Specifications for Highway Bridges, Division II - Construction.

1. Test bearings, in addition to the bearings shown on the plans, shall be furnished for each type (size and thickness) of bearing for destructive testing. The test bearings shall be furnished without external load plates.

C. **Marking:** Each steel-laminated elastomeric bearing shall have marked on it, with indelible ink, the following: the manufacturer's identification code or symbol, and the month and year of manufacture, the orientation, order number, lot number, bearing identification number, and elastomer type and grade (Neoprene, Grade 3). The markings should be placed on a side of the bearing that is visible after installation.

D. **Installation:**

1. Bearing areas, upon which the elastomeric bearings will be set, shall be cleaned of all debris. Bearing areas shall be carefully finished, by grinding, if necessary, to a smooth, even, level surface of the required elevation, and shall show no variations from a true plane greater than 1/16 over the entire area upon which the elastomeric bearings are to rest.

2. The elastomeric bearings shall be installed as shown on the plans. The elastomeric bearings shall be installed when the temperature of the ambient air and the bearings is between 40 deg. F to 60 deg. F and has been within this range for at least 2 hours.
3. Adhesive bonding of the elastomeric bearings to steel and concrete surfaces is not permitted.
4. Welding, with the elastomeric bearings in place, will not be permitted unless there is more than 1½” of steel between the weld and the elastomer. In no case shall the elastomer be exposed to temperatures greater than 158 deg. F. Welding shall conform to the requirements of CTDOT Form 816 Subarticle 6.03.03-4(e).
5. Assembly with high strength bolts shall conform to the requirements of CTDOT Form 816 Subarticle 6.03.03-4(f).
6. The elastomeric bearings shall bear uniformly on all surfaces under full dead load.

END OF SECTION 34 82 10

PERMITS AND/OR SUPPLEMENTAL TO FORM 816 AND REQUIRED PROVISIONS

The following Permits and/or Supplemental to Form 816 and Required Provisions follow this page and are hereby made part of this Contract.

- **PERMITS AND/OR PERMIT APPLICATIONS**

No Permits are required for this contract.

- **SUPPLEMENTAL SPECIFICATIONS TO STANDARD SPECIFICATIONS FORM 816**

- **Construction Contracts - Required Contract Provisions (State Funded Only Contracts)**

State of Connecticut

Department of Transportation

**SUPPLEMENTAL SPECIFICATIONS
TO
THE STANDARD SPECIFICATIONS
FOR
ROADS, BRIDGES AND INCIDENTAL CONSTRUCTION
FORM 816
2004**

JULY 2015

July 2015

DIVISION I
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6.03	Structural Steel	603
6.12	Concrete Cylinder Curing Box	612
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7.01	Drilled Shafts	701
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8.11	Concrete Curbing	811
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9.10	Metal Beam Rail	910
9.18	Three-Cable Guide Railing (I-Beam Post) and Anchorages	918
9.21	Concrete Sidewalks and Ramps	921
9.22	Bituminous Concrete Sidewalk Bituminous Concrete Driveway	922
9.44	Topsoil	944
9.49	Furnishing, Planting and Mulching Trees, Shrubs, Vines and Ground Cover Plants	949
9.50	Turf Establishment	950
9.75	Mobilization and Project Closeout	975
9.77	Traffic Cone	977
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10.01	Trenching and Backfilling	1001
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11.13	Control Cable	1113
12.07	Sign Face – Extruded Aluminum	1207
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DIVISION II
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12.10	Epoxy Resin Pavement Markings, Symbols and Legends	1210
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18.06	Type D Portable Impact Attenuation System	1806

July 2015

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SECTION

**SPECIFICATION
NUMBER**

M.03	Portland Cement Concrete	M03
M.06	Metals	M06
M.08	Drainage	M08
M.11	Masonry Facing, Cement and Dry Rubble Masonry, Brick, Mortar	M11
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JULY 2015
STANDARD SPECIFICATIONS
FOR
ROADS, BRIDGES AND INCIDENTAL CONSTRUCTION
FORM 816

ERRATA

<u>PG.</u>	<u>ARTICLE OR SUBARTICLE</u>	<u>LINE NO.</u>	<u>CORRECTION</u>	<u>REV. DATE</u>
i	Table of Contents	20	Insert "1.11 Claims".....	July10
iii	Table of Contents	10	Insert "7.01 Drilled Shafts".....	July14
iii	Table of Contents	15	Insert "7.06 Micropiles".....	July14
iv	Table of Contents	11	Change "Guild" to "Guide"	Jan05
iv	Table of Contents	13	Change "Concrete Sidewalks" to "Concrete Sidewalks and Ramps".....	July15
v	Table of Contents	2	Change "Mobilization" to "Mobilization and Project Closeout".....	July14
vi	Table of Contents	21	Change "Sign Face – Extruded Aluminum (Type III Reflective Sheeting)" to "Sign Face – Extruded Aluminum".....	Jan15
vi	Table of Contents	33	Change "Construction Signs – Encapsulated Lens Type III Reflective Sheeting" to "Construction Signs".....	Jan15
32	1.05.01	38	Change "Connecticut General Statutes" to "CGS".....	Jan05
97	1.10.03-2	32	Change "D.E.P." to "DEEP".....	Jan14
97	1.10.03-2	39	Change "D.E.P." to "DEEP,".....	Jan14
98	1.10.03-2.1	13	Change "D.E.P." to "DEEP".....	Jan14
99	1.10.03-2.6	23	Change "D.E.P." to "DEEP".....	Jan14
100	1.10.03-2.9	32	Change "D.E.P." to "DEEP".....	Jan14
101	1.10.03-2.12	22	Change "D.E.P." to "DEEP".....	Jan14
102	1.10.04	26	Change "D.E.P." to "DEEP".....	Jan14
105	1.20	29	Change "Workmen and Equipment" to "Personnel and Equipment".....	Jan05
105	1.20	31	Delete "Completion of Construction Work and".....	Jan05
108	1.20-1.04.01	26	Change "othewise" to "otherwise".....	July07
122	1.20-1.06.08	3	Change "Certificate of Compliance" to "C.O.C.".....	July07
131	1.20-1.08.05	34	Change "Workmen and Equipment" to "Personnel and Equipment".....	Jan05
132	1.20-1.08.11	12	Change "Certificate of Compliance" to "C.O.C.".....	July07
133	1.20-1.08.13	7	Delete "Completion of Construction Work and".....	Jan05
133	1.20-1.08.13	9	Change "Certificate of Compliance" to "C.O.C.".....	July07
133	1.20-1.08.13	15	Change "Certificate of Compliance" to "C.O.C.".....	July07
133	1.20-1.08.13	20	Change "Certificate of Compliance" to "C.O.C.".....	July07
164	2.04.03-1	2	Change "6.01.03-10" to "6.01.03-6".....	Jan14
196	3.03.02	33	Change "Article M.03.01" to "Section M.03".....	Jan14
203	3.05.05	21	Change "(t) to "(mton)".....	Jan15
230	4.03.05	38	Change "(t) to "(mton)".....	Jan15
245	4.06.04	11	Change " Over weight (mass) Adjustments - " and replace with indented "Over weight (mass) Adjustments -" as a subsection of " 1. Bituminous Concrete Class () .".....	Jan05

<u>PG.</u>	<u>ARTICLE OR SUBARTICLE</u>	<u>LINE NO.</u>	<u>CORRECTION</u>	<u>REV. DATE</u>
256	5.01.02	22	Change "DEP" to "DEEP".....	Jan14
259	5.03.03	24	Change "Such requirements of Article 5.02.03 ... equally to this construction." to "All such plans prepared by the Contractor shall be considered working drawings and shall be submitted with engineering calculations to the Engineer for review in accordance with the requirements of Article 1.05.02.".....	July10
262	5.06.02	26	Change "Article M.03.01" to "Section M.03".....	Jan14
262	5.06.02	27	Change "Article M.03.01" to "Section M.03".....	Jan14
265	5.07.02	19	Change "Subarticle M.03.01-11" to "Article M.03.09".....	Jan14
265	5.07.02	23	Change "Approved Products List for Geotextiles referred to in Subarticle M.08.01-26." to "Qualified Products List referred to in Subarticle M.08.01-19 Geotextiles.".....	July14
271	5.09.02	39	Change "M.06.02-12" to "M.06.02-4 Welded Stud Shear Connectors".....	July10
272	5.13.02	22	Change "M.08.01-27" to "M.08.01-20 PVC Pipe or M.08.01-21 PVC Gravity Pipe".....	July13
378	6.52.02	2	Change "M.08.01-22" to "M.08.01-11 Reinforced Concrete Culvert End".....	July13
378	6.52.02	3	Change "M.08.01-23" to "M.08.01-6 Metal Culvert End".....	July13
378	6.52.02	4	Change "gravel fill" to "granular fill".....	Jan15
378	6.52.03	12	Change "gravel fill" to "granular fill".....	Jan15
378	6.52.04	22	Change "gravel fill" to "granular fill".....	Jan15
378	6.52.05	35	Change "gravel fill" to "granular fill".....	Jan15
404	7.05.02	11	Change "Article M.03.01" to "Section M.03".....	Jan14
414	7.28.05	4	Change "(t) to "(mton)".....	Jan15
416	7.51.02-(4)	7	Change "M.08.01-26" to "M.08.01-19 Geotextiles".....	July13
418	7.55.02	26	Change "M.08.01-26" to "M.08.01-19 Geotextiles".....	July13
420	8.11.02	37	Change "Article M.03.01" to "Section M.03".....	Jan14
420	8.11.02	38	Change "Article M.03.01" to "Subarticle M.03.08-2".....	Jan14
421	8.11.02	1	Change "Article M.03.01" to "Section M.03".....	Jan14
421	8.11.03-4	42	Change "4.01.03 for concrete pavement" to " 6.01.03 Concrete for Structures".....	Jan15
422	8.11.04	12	Change "meters" to "linear feet (meters)".....	Jan15
426	8.16.02	28	Change "Subarticle M.03.01-8" to "Article M.03.08".....	Jan14
428	8.18.02	10	Change "Subarticle M.03.01-11" to "Article M.03.09".....	Jan14
429	8.21.02-6	30	Change "M.03.01-11" to "Article M.03.09".....	Jan14
430	8.21.03-6	37	Change "M.03.01-11" to "Article M.03.09".....	Jan14
434	9.04.02	14	Change "Subarticle M.06.02-1" to "Article 6.03.02".....	July10
434	9.04.02	15	Change "M.06.02-9(d) for metal bridge rail (cast post—aluminum)" to "Malleable castings shall conform to the requirements of the specifications for malleable iron castings, ASTM A 47, Grade No. 32510 (22010). Ductile iron castings shall conform to the Specifications for Ductile Iron Castings, ASTM A 536, Grade 60-40-18 (414-276-18) unless otherwise specified. In addition to the specified test coupons, test specimens from parts integral with the castings, such as risers, shall be tested for castings having a weight (mass) of more	

<u>PG.</u>	<u>ARTICLE OR SUBARTICLE</u>	<u>LINE NO.</u>	<u>CORRECTION</u>	<u>REV. DATE</u>
			than 1000 pounds (455 kilograms) to determine that the required quality is obtained in the castings in the finished condition.”.....	July10
445	9.11.02	14	Change “Subarticle M.03.01-12” to “Article M.03.05”.....	Jan14
452	9.14.02	2	Change “Subarticle M.06.02-8” to “ASTM A 53, Type E or S, Grade A, Schedule 40 Black Finish.”.....	July10
452	9.14.02	4	Change “Subarticle M.06.02-9(d) except that the grade shall be 32510” to “the specifications for malleable iron castings, ASTM A 47, Grade No. 32510 (22010). Ductile iron castings shall conform to the Specifications for Ductile Iron Castings, ASTM A 536, Grade 60-40-18 (414-276-18) unless otherwise specified. In addition to the specified test coupons, test specimens from parts integral with the castings, such as risers, shall be tested for castings having a weight (mass) of more than 1000 pounds (455 kilograms) to determine that the required quality is obtained in the castings in the finished condition.”.....	July10
454	9.16.02	20	Change “Article M.03.01” to “Section M.03”.....	Jan14
464	9.23.05	9	Change “ton (t)” to “ton (mton)”.....	Jan15
464	9.24.02-1	19	Change “Article M.03.01” to “Section M.03”.....	Jan14
467	9.30.02	36	Change “reflective” to “retroreflective”.....	July15
467	9.30.02	39	Change “reflective” to “retroreflective”.....	July15
471	9.42.05	9	Change “(t)” to “(mton)”.....	Jan15
475	9.46.05	2	Change “(t)” to “(mton)”.....	Jan15
475	9.47.02-5	34	Change “Article M.03.01” to “Section M.03”.....	Jan14
496	9.70.01	37	Change “CDOT” to “ConnDOT”.....	Jan05
517	10.00	21	Add “10.00.14—Maintenance of Illumination During Construction”.....	July14
518	10.00.03(2)	41	Change “pre-emotion” to “pre-emption”.....	July14
519	10.00.04	12	Capitalize “Section”.....	July14
519	10.00.04	18	Capitalize “Project”.....	July14
533	10.02.02	6	Change “Article M.03.01” to “Section M.03”.....	Jan14
544	10.11.02	5	Change “M.08.01-25 or M.08.01-27” to “M.08.01-20 or M.08.01-21”.....	July13
548	10.17.03	14	Change “6.01.03-21” to “6.01.03-10”.....	Jan14
552	11.03.03-1	18	Change “M.03.01-12” to “M.03.05”.....	Jan14
569	11.14.05	19	Change “Span Wire” to “Span Wire (Type)”.....	July12
576	12.01.02	40	Change “Subarticle M.03.01-12” to “Article M.03.05”.....	Jan14
577	12.01.03	7	Change “6.03.03-19” to “6.03.03-4 (f) High Strength Bolted Connections”.....	July10
577	12.01.03	23	Change “Article 6.03.03-15” to “Subarticle 6.03.03-4(c) Bearings”.....	July10
577	12.01.03	27	Change “Article 6.03.03-19 (c)(3)” to “Subarticle 6.03.03-4 (f) High Strength Bolted Connections Turn-of-Nut Installation Method”.....	July10
578	12.02.02	23	Change “M.03.01-12” to “M.03.05”.....	Jan14
580	12.02.03	16	Change “6.01.03-21” to “6.01.03-10”.....	Jan14

<u>PG.</u>	<u>ARTICLE OR SUBARTICLE</u>	<u>LINE NO.</u>	<u>CORRECTION</u>	<u>REV. DATE</u>
583	12.05.01	10	Change "reflective" to "retroreflective".....	July15
583	12.05.02	15	Change "Reflective" to "Retroreflective".....	July15
583	12.05.02	16	Change "either Subarticle M.18.09.01 (Type V) or M.18.09.02" to "Article M.18.09".....	Jan15
583	12.05.03	28	Change "reflective" to "retroreflective".....	July15
583	12.05.04	35	Change "12.05.040" to "12.05.04".....	July14
598	12.12.02	1	Change "reflective" to "retroreflective".....	July15
604	18.02.02	36	Change "Approved Products List" to "Qualified Products List".....	July14
609	18.07.02	30	Change "M18" to "M.18".....	July14
638	M.04.02	37	Change "Asphalt Institute's" to "AI's".....	Jan05
705	M.09.02-2	18	Change "Article M.09.02(1)" to "Subarticle M.09.02-1".....	July14
708	M.09.02-5	5	Change "Article M.03.01" to "Section M.03".....	Jan14
708	M.09.02-6	40	Change "Article M.03.01-2" to "Subarticle M.03.01-2".....	July14
711	M.10.02-1	17	Change "Subarticle M.06.02-1(b)" to "Article M.06.02".....	July10
713	M.10.02-7	8	Change "Article M.03.01" to "Section M.03".....	Jan14
720	M.10.08-3	2	Change "Subarticle M.06.02-1(b)" to "Article M.06.02".....	July10
720	M.10.08-4	10	Change "Article M.03.01" to "Section M.03".....	Jan14
726	M.12.03	18	After "M.03.01" add "and M.03.02".....	Jan14
731	M.12.08-3	20	Change "Article M.06.01-1" to "Subarticle M.06.01-1".....	July14
748	M.14.01-3	42	Change "Article M.06.01-1" to "Subarticle M.06.01-1".....	July14
749	M.14.01-4	2	Change "Article M.08.01-5" to "Subarticle M.08.01-5".....	July14
749	M.14.01-7	22	Change "Article M.14.01-2" to "Subarticle M.14.01-2".....	July14
749	M.14.01-8	32	Change "Article M.03.01-12" to "Article M.03.05".....	Jan14
758	M.15.10	9	Change "Article M.15.09-1" to "Subarticle M.15.09-1".....	July14
759	M.15.15-4	23	Change "Article M.16.03.2" to "Subarticle M.16.03-2".....	July14
759	M.15.15-5	26	Change Article M.15.02.2" to "Subarticle M.15.02-2".....	July14
759	M.15.15-5	24	Change "Article M.03.01" to "Section M.03".....	Jan14
759	M.15.15-6	27	Change "Article M.03.01" to "Section M.03".....	Jan14
760	M.15.15-16	21	Change "non-fusible" to "fused".....	Jan05
823	Pay Items	28	Change "ton (t)" to "ton (mton)".....	Jan15
823	Pay Items	29	Change "ton (t)" to "ton (mton)".....	Jan15
823	Pay Items	35	Change "ton (t)" to "ton (mton)".....	Jan15
824	Pay Items	4	Change "ton (t)" to "ton (mton)".....	Jan15
825	Pay Items	25	Change "l.s. (l.s.)" to "ea. (ea.)".....	Jan15
828	Pay Items	29	Add "7.01, Furnishing Drilled Shaft Drilling Equipment, l.s. (l.s.)".....	July14
828	Pay Items	30	Add "7.01, Drilled Shaft (Diameter), l.f. (m)".....	July14
828	Pay Items	31	Add "7.01, Drilled Shaft Earth Excavation (Diameter), l.f. (m)".....	July14
828	Pay Items	32	Add "7.01, Drilled Shaft Rock Excavation (Diameter), l.f. (m)".....	July14
828	Pay Items	33	Add "7.01, Obstructions, hr. (hr.)".....	July14
828	Pay Items	34	Add "7.01, Trial Drilled Shaft (Diameter), l.f. (m)".....	July14
828	Pay Items	35	Add "7.01, Exploration Test Boring, l.f. (m)".....	July14
828	Pay Items	36	Add "7.01, Permanent Casing (Diameter), l.f. (m)".....	July14
828	Pay Items	37	Add "7.01, Access Tubes, l.f. (m)".....	July14

<u>PG.</u>	<u>ARTICLE OR SUBARTICLE</u>	<u>LINE NO.</u>	<u>CORRECTION</u>	<u>REV. DATE</u>
829	Pay Items	4	Add "7.02, Dynamic Pile Driving Analysis (PDA) Test, ea. (ea.)".....	July13
829	Pay Items	5	Add "7.02, Pre-Augering of Piles, I.f. (m)".....	July13
829	Pay Items	13	Add "7.06, Micropiles, ea. (ea.)".....	July14
829	Pay Items	14	Add "7.06, Verification Test for Micropiles, ea. (ea.)".....	July14
829	Pay Items	15	Add "7.06, Proof Test for Micropiles, ea. (ea.)".....	July14
829	Pay Items	16	Add "7.06, Micropile Length Adjustment, I.f. (m)".....	July14
829	Pay Items	24	Change "ton (t)" to "ton (mton)"	Jan15
833	Pay Items	14	Add "9.21, Concrete Sidewalk Ramp, s.f."	July15
833	Pay Items	15	Add "9.21, Detectable Warning Strip, ea.".....	July15
833	Pay Items	16	Add "9.21, Retrofit Detectable Warning Strip, ea.".....	July15
833	Pay Items	20	Change "ton (t)" to "ton (mton)"	Jan15
834	Pay Items	4	Change "ton (t)" to "ton (mton)"	Jan15
835	Pay Items	3	Change "Mobilization" to "Mobilization and Project Closeout".....	July14
837	Pay Items	24	Change "Span Wire" to "Span Wire (Type)"	July12
839	Pay Items	3	Change "Sign Face – Extruded Aluminum (Type III Reflective Sheeting)" to "Sign Face – Extruded Aluminum".....	Jan15
840	Pay Items	6	Change "Construction Signs – Type III Reflective Sheeting" to "Construction Signs".....	Jan15
845	Index	6	Add page 133 to "Acceptance of Project"	Jan05
846	Index	13	Add page 107 to "Bids: Consideration of".....	Jan05
847	Index	28	Add page 132 to "Cleaning Up, Final".....	Jan05
849	Index	25	Add page 107 to "Consideration of Bids".....	Jan05
849	Index	39	Add page 108 to "Contract: Intent of".....	Jan05
850	Index	3	Add page 133 to "Contractor's: Responsibility, Termination of the".....	Jan05
850	Index	13	Add page 114 to "Cooperation by Contractor"	Jan05
850	Index	15	Add page 114 to "Coordination of Special Provisions, Plans, Supplemental Specifications and Standard Specifications and Other Contract Requirements".....	Jan05
850	Index	40	Add page 128 to "Cutting and Patching:".....	Jan05
852	Index	16	Add page 106 to "Examination of Plans, Specifications, Special Provisions and Site of Work"	Jan05
852	Index	38	Insert "Facilities, Temporary...126".....	Jan05
853	Index	7	Add page 132 to "Final: Cleaning Up".....	Jan05
854	Index	35	Add page 115 to "Inspection"	Jan05
855	Index	11	Add page 108 to "Intent of Contract".....	Jan05
855	Index	22	Add page 106 to "Knowledge of Applicable Laws".....	Jan05
855	Index	25	Add page 106 to "Laws: Knowledge of Applicable".....	Jan05
856	Index	27	Add page 120 to "Materials: Source of Supply and Quality"....	Jan05
856	Index	28	Add page 121 to "Materials: Storage of".....	Jan05
857	Index	33	Add page 133 to "Operation and Maintenance Manuals:".....	Jan05
857	Index	34	Change page 133 to 136 for "Equipment and Systems Maintenance Manual".....	Jan05
859	Index	2	Add page 131 to "Personnel and Equipment".....	Jan05

<u>PG.</u>	<u>ARTICLE OR SUBARTICLE</u>	<u>LINE NO.</u>	<u>CORRECTION</u>	<u>REV. DATE</u>
860	Index	6	Add page 114 to "Plans: Coordination of Special Provisions, Supplemental Specifications and Standard Specifications and Other Contract Requirements".....	Jan05
860	Index	7	Add page 106 to "Plans: Examination of".....	Jan05
860	Index	30	Change page 108 to 112 for "Product Data".....	Jan05
860	Index	31	Change page 108 to 112 for "Product Samples".....	Jan05
860	Index	32	Add page 124 to "Product Selection:".....	Jan05
861	Index	12	Add page 126 to "Prosecution of Work".....	Jan05
861	Index	38	Change page 115 to 135 for "Record Drawings".....	Jan05
863	Index	3	Add page 125 to "Sanitary Provisions".....	Jan05
863	Index	18	Insert "Services, Temporary...126".....	Jan05
863	Index	23	Add page 111 to "Shop Drawings".....	Jan05
864	Index	4	Add page 106 to "Site of Work, Examination of".....	Jan05
864	Index	12	Add page 120 to "Source of Supply and Quality".....	Jan05
864	Index	19	Add page 114 to "Special Provisions: Coordination of Plans, Supplemental Specifications and Standard Specifications and Other Contract Requirements".....	Jan05
864	Index	20	Add page 106 to "Special Provisions: Examination of".....	Jan05
864	Index	26	Add page 114 to "Specifications: Coordination of Plans, Special Provisions and Other Contract Requirements".....	Jan05
864	Index	27	Add page 106 to "Specifications: Examination of".....	Jan05
864	Index	43	Add page 121 to "Storage".....	Jan05
865	Index	27	Delete page 108 from "Submittals: Shop Drawings".....	Jan05
865	Index	45	Insert "Temporary Utilities, Services, and Facilities...126"....	Jan05
866	Index	2	Add page 133 to "Termination of Contractor's Responsibility".....	Jan05
866	Index	23	Insert "Training...137".....	Jan05
866	Index	45	Add page 133 to "Utility Services".....	Jan05
867	Index	8	Insert "Warranties...121".....	Jan05
867	Index	24	Add page 126 to "Work: Prosecution of".....	Jan05

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 1.01
DEFINITIONS OF TERMS AND
PERMISSIBLE ABBREVIATIONS**

1.01.01 — Definitions:

After the definition for “Award” add the following definition:

“BID: The submission of a proposal for the work contemplated.”

After the definition for “Bid Manual” add the following definition:

“BIDDER: Any individual, firm, partnership, corporation, or combination thereof, submitting a proposal for the work contemplated, acting directly or through a duly authorized representative.”

After the definition for “Calendar Day” add the following definition:

“CATALOG CUT (PRODUCT DATA): Document(s) with information such as manufacturer’s product specifications, manufacturer’s installation instructions, standard color charts, wiring diagrams showing factory-installed wiring, printed performance curves and operational range diagrams. Product data that must be specially prepared because standard printed data is not suitable shall be considered shop drawings.”

Change the title of “Construction Order” to “Construction Order, Change Order.”

After the definition for “Contractor” add the following definition:

“CULVERT: A covered channel or a large pipe for carrying a watercourse below ground level, usually under a road or railway.”

After the definition for “Material” add the following definitions:

“MUNICIPALITY: City, town or county.

NOTICE TO PROCEED: A written notice issued by the Engineer to the Contractor stating the date on which the Contractor is authorized to commence and proceed with the Contract work.”

After the end of the definition for “Plans” insert the following:

“A. Standard Sheets – Standardized plans containing details approved by the Department and the FHWA, for construction of a given type on any project, included in contracts on an as-needed basis.

PRODUCT DATA (CATALOG CUT): Document(s) with information such as manufacturer's product specifications, manufacturer's installation instructions, standard color charts, wiring diagrams showing factory-installed wiring, printed performance curves and operational range diagrams. Product data that must be specially prepared because standard printed data is not suitable shall be considered shop drawings."

After the definition for "Project Site" add the following definition:

"QUALIFIED PRODUCTS LIST (QPL): A report that has been developed as a means for determining what products, suppliers, manufacturers, equipment and methodologies may be used on construction projects. This report can be located on the CT Department of Transportation Website."

After the definition for "Reclaimed Waste" add the following definition:

"RIGHT-OF-WAY: A general term denoting land, property of interest therein, usually in a strip, acquired for or devoted to transportation purposes."

After the definition for "Subcontractor" add the following definition:

"SUBSTANTIAL COMPLETION: The date at which the performance of all work on the Project has been completed except minor or incidental items, final cleanup, work required under a warranty, and repair of unacceptable work, and provided the Engineer has determined that:

- A. The Project is safe and convenient for use by the public, and
- B. All traffic lanes including all safety appurtenances are in their final configuration, and
- C. Failure to complete the work and repairs excepted above does not result in the deterioration of other completed work; and provided further, that the value of work remaining to be performed, repairs, and cleanup is less than one percent (1%) of the estimated final Contract amount, and
- D. If applicable a Certificate of Compliance has been issued."

1.01.02 — Abbreviations, Publications, and Standards:

Delete the entire Article and replace with the following:

" 1.01.02—Abbreviations, Publications and Standards: Whenever one of the following abbreviations is used in the Contract, its meaning shall be interpreted as follows:

AA—Aluminum Association, Inc. (The)

AABC—Associated Air Balance Council

AAMA—American Architectural Manufacturers Association

AAPA—American Association of Port Authorities

AASHTO—American Association of State Highway and Transportation Officials:

Wherever reference is made to an AASHTO Standard Method of Test or Standard Specification, it refers by letter and number to the method or specification published

by AASHTO in the "Standard Specifications for Transportation Materials and Methods of Sampling and Testing". The edition governing the work shall be in effect on the date the Contract was advertised for solicitation of bids shall govern.

ABMA—American Bearing Manufacturers Association
ACGIH—American Council of Government Industrial Hygienists
ACI—ACI International (American Concrete Institute)
ADAAG—Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities
ADSC—The International Association of Foundation Drilling
AF&PA—American Forest & Paper Association
AGA—American Gas Association
AGC—Associated General Contractors of America (The)
AHA—American Hardboard Association
AHAM—Association of Home Appliance Manufacturers
AI—Asphalt Institute
AIA—The American Institute of Architects (The)
AISC—American Institute of Steel Construction
AISI—American Iron and Steel Institute
AITC—American Institute of Timber Construction
A.L.I.—Automotive Lift Institute
ALSC—American Lumber Standard Committee, Incorporated
AMCA—Air Movement and Control Association International, Inc.
ANLA—American Nursery and Landscape Association
ANSI—American National Standards Institute
AOAC—AOAC International
AOSA—Association of Official Seed Analysts
APA—APA-The Engineered Wood Association
API—American Petroleum Institute
AREMA—American Railway Engineering and Maintenance-of-Way Association
ARI—Air-Conditioning & Refrigeration Institute
ARTBA—American Road and Transportation Builders Association
ASA—Acoustical Society of America
ASC—Adhesive and Sealant Council
ASCE—American Society of Civil Engineers
ASHRAE—American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME—ASME International (The American Society of Mechanical Engineers International)
ASNT—American Society for Non-Destructive Testing
ASSE—American Society of Sanitary Engineering
ASTM—American Society of Testing and Materials (ASTM International): Wherever reference is made to an ASTM specification, test method, or practice, it refers by letter, number, or both to standards published by ASTM International in the "ASTM Standards Source™ Database". The edition governing the work shall be in effect on the date the Contract was advertised for solicitation of bids shall govern.
ATSSA—American Traffic Safety Services Association
AWI—Architectural Woodwork Institute
AWPA—American Wood-Preservers' Association
AWPI—American Wood Preservers Institute

AWS—American Welding Society: Wherever reference is made to an AWS materials specification, inspection methods, or welding procedures, it refers by section number to standards of the American Welding Society published in the applicable steel, or aluminum welding code. The edition governing the work shall be in effect on the date the Contract was advertised for solicitation of bids shall govern.

AWWA—American Water Works Association

BHMA—Builders Hardware Manufacturers Association

BIA—Brick Industry Association (The)

BOCA—BOCA International, Inc.

CBM—Certified Ballast Manufacturers Association

CCRL—Cement and Concrete Reference Laboratory

CDA—Copper Development Association (The)

CGA—Compressed Gas Association

CISCA—Ceilings and Interior Systems Construction Association

CLFMI—Chain Link Fence Manufacturers Institute

ConnDOT—Connecticut Department of Transportation

CFR—Code of Federal Regulations

CGS—Connecticut General Statutes

CISPI—Cast Iron Soil Pipe Institute

CRI—Carpet and Rug Institute (The)

CRSI—Concrete Reinforcing Steel Institute

CSI—Construction Specifications Institute (The)

CSSB—Cedar Shake & Shingle Bureau

CTI—Cooling Technology Institute

DASMA—Door and Access Systems Manufacturers Association, International

~~DEP—Connecticut Department of Environmental Protection~~ *see DEEP*

DEEP—Connecticut Department of Energy and Environmental Protection

DHI—Door and Hardware Institute

DOD—Department of Defense Military Specifications and Standards

~~DPUC—Department of Public Utility Control~~ *see PURA*

EIA—Electronic Industries Alliance

EPA—Environmental Protection Agency

FAA—Federal Aviation Administration

FCC—Federal Communications Commission

FCICA—Floor Covering Installation Contractors Association

FHWA—Federal Highway Administration

FMG—FM Global

FRA—Federal Railway Administration

FS—Wherever reference is made to FS in the contract, it refers by number, letter, or both, to the latest standard or tentative standard of the Federal Specification Unit, General Services Administration, Federal Supply Service, as to materials, specifications, or methods of testing, whichever the case may be.

FTA—Federal Transit Administration

GA—Gypsum Association

GANA—Glass Association of North America

GSA—General Services Administration

HI—Hydraulics Institute

HPVA—Hardwood Plywood & Veneer Association

ICC—International Code Council

ICC-ES—ICC Evaluation Service, Inc.
 ICEA—Insulated Cable Engineers Association, Inc.
 IEC—International Electrotechnical Commission
 IEEE—Institute of Electrical and Electronics Engineers, Inc. (The)
 IES—Illuminating Engineers Society
 IESNA—Illuminating Engineering Society of North America
 IGCC—Insulating Glass Certification Council
 IGMA—Insulating Glass Manufacturers Alliance
 IMSA—International Municipal Signal Association
 IRI—HSB Industrial Risk Insurers
 ISO—International Organization for Standardization
 ITE—Institute of Traffic Engineers
 KCMA—Kitchen Cabinet Manufacturers Association
 LMA—Laminating Materials Association
 LPI—Lightning Protection Institute
 MASH—Manual for Assessing Safety Hardware
 MBMA—Metal Building Manufacturers Association
 MILSPEC—Military Specification and Standards
 MMA—Monorail Manufacturers Association
 MSHA—Mine Safety and Health Administration
 MSS—Manufacturers Standardization Society of The Valve and Fittings the Valve Industry, Inc.
 MUTCD—Manual on Uniform Traffic Control Devices
 NAAMM—National Association of Architectural Metal Manufacturers
 NADCA—National Air Duct Cleaners Association
 NAIMA—North American Insulation Manufacturers Association (The)
 NBFU—National Board of Fire Underwriters
 NCHRP—National Cooperative Highway Research Program
 NCMA—National Concrete Masonry Association
 NCPI—National Clay Pipe Institute
 NEBB—Natural Environmental Balancing Bureau
 NEC—National Electrical Code
 NECA—National Electrical Contractors Association
 NEMA—National Electrical Manufacturers Association
 NEPCOAT—North East Protective Coatings Committee
 NESC—National Electrical Safety Code
 NETA—InterNational Testing Association
 NETTCP—NorthEast Transportation Technician Certification Program
 NFPA—National Fire Protection Association
 NFRC—National Fenestration Rating Council
 NHLA—National Hardwood Lumber Association
 NICET—National Institute for Certification in Engineering Technologies
 NIOSH—National Institute of Occupational Safety and Health
 NIST—National Institute of Standards and Technology
 NLGA—National Lumber Grades Authority
 NOAA—National Oceanic and Atmospheric Administration
 NRCA—National Roofing Contractors Association
 NSF—NSF International
 NTMA—National Terrazzo and Mosaic Association, Inc.

OEO—Office of Equal Opportunity
 OSHA—Occupational Safety and Health Administration
 PCA—Portland Cement Association
 PCI—Precast/Prestressed Concrete Institute
 PDI—Plumbing & Drainage Institute
 PTI—Post-Tensioning Institute
 PURA—Public Utilities Regulatory Authority
 RMA—Rubber Manufacturers Association
 SAE—SAE International
 SDI—Steel Deck Institute *or*
—Steel Door Institute
 SFPA—Southern Forest Products Association
 SHRP—Strategic Highway Research Program
 SJI—Steel Joist Institute
 SMACNA—Sheet Metal and Air Conditioning Contractors National Association
 SPIB—Southern Pine Inspection Bureau (The)
 SPRI—Single Ply Roofing Institute
 SSPC—Where reference is made to SSPC in the Contract, it refers by number, letter, or both, to the latest standard or tentative standard specification of The Society for Protective Coatings, Formerly the Steel Structures Painting Council, as to materials specifications, methods of testing, systems, procedures, inspection or other specification pertaining to any or all phases of cleaning or painting, whichever may apply.
 SWRI—Sealant, Waterproofing, & Restoration Institute
 TCA—Tile Council of America, Inc.
 TIA—Telecommunications Industry Association
 TIA/EIA—Telecommunications Industry Association/Electronics Industries Alliance
 TPI—Truss Plate Institute, Inc.
 TRB—Transportation Research Board
 UFAS—Uniform Federal Accessibility Standards
 UL—Underwriters Laboratories Inc.
 USDA—United States Department of Agriculture
 USGBC—U.S. Green Building Council
 WCLIB—West Coast Lumber Inspection Bureau
 WCSC—Window Covering Safety Council
 WDMA—Window & Door Manufacturers Association
 WWPA—Western Wood Products Association”

1.01.03 — Abbreviations and Terms:

Add the following abbreviations:

“ACSR – Aluminum Conductor, Steel Reinforced
 AOEC – Area of Environmental Concern
 APA – Aquifer Protection Area
 AWG – American Wire Gauge
 CMS – Changeable Message Sign
 cu.dm - Cubic Decimeter

cu.m - Cubic Meters
CWI – Certified Welding Inspector
dm³ - Cubic Decimeter
DMT – Division of Materials Testing
DTI – Direct Tension Indicator
est. – estimated
FRC – Fiberglass Reinforced Composite
HASP – Health and Safety Plan
m² - Square Meter
m³ - Cubic Meters
MSDS—Material Safety Data Sheet(s)
mton - Metric Ton
NDT – non-destructive testing
PCC – Portland Cement Concrete
sq.m - Square Meter
SSA – Sole Source Aquifer
TL – Test Level
TMA – Truck Mounted Impact Attenuator
TMP – Transportation Management Plan
TTC – Temporary Traffic Control
Vert. M - Vertical Meter
vert.m - Vertical Meter
VMS – Variable Message Sign
VOC – Volatile Organic Compound
WSA – Temporary Waste Stockpile Area”

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 1.02
PROPOSAL REQUIREMENTS AND CONDITIONS**

In the list of articles, make the following changes:

**“1.02.02—Vacant
1.02.05—Vacant
1.02.06—Vacant
1.02.07—Vacant
1.02.08—Vacant
1.02.09—Vacant
1.02.10—Vacant
1.02.11—Vacant
1.02.14—Vacant
1.02.15—Vacant”**

1.02.01 – Contract Bidding and Award:

Replace the entire article with the following:

“1.02.01—Contract Bidding and Award: All bids for construction contracts must be submitted electronically. It is the responsibility of each bidder and all other interested parties to obtain all bidding related information and documents from the Department of Administrative Services (DAS) State Contracting Portal.

Connecticut Department of Transportation bidding and other information and documents which are obtained from any other source must not be submitted to the Department. Reproduced, reformatted or altered forms of documents are not authorized or acceptable.

For information about the bidding and award of Department construction contracts, consult the “State of Connecticut Department of Transportation Construction Contract Bidding and Award Manual,” available from the Division of Contracts. In order to be eligible for award of a Department construction contract, a bidder must follow the requirements of this Bid Manual, and all bidding and award matters regarding Department construction contracts shall be governed by the terms of the Bid Manual, unless treated otherwise in the Contract, including these Specifications.”

*Replace “1.02.02—Competence of Bidder: See Article 1.02.01.” with
“1.02.02—Vacant”*

*Replace “1.02.05—Preparation of Proposals: See Article 1.02.01.” with
“1.02.05—Vacant”*

*Replace “1.02.06—Rejection of Non-responsive Proposals: See Article
1.02.01.” with “1.02.06—Vacant”*

*Replace “1.02.07—Proposal Guaranty: See Article 1.02.01.” with
“1.02.07—Vacant”*

*Replace “1.02.08—Delivery of Proposal: See Article 1.02.01.” with
“1.02.08—Vacant”*

*Replace “1.02.09—Withdrawal of Proposals: See Article 1.02.01.” with
“1.02.09—Vacant”*

*Replace “1.02.10—Public Opening of Proposals: See Article 1.02.01.” with
“1.02.10—Vacant”*

*Replace “1.02.11—Miscellaneous Grounds for Rejection of Proposals: See
Article 1.02.01.” with “1.02.11—Vacant”*

*Replace “1.02.14—Sworn Statement by Bidder: See Article 1.02.01.” with
“1.02.14—Vacant”*

*Replace “1.02.15—Required Certifications of Eligibility to Bid: See Article
1.02.01.” with “1.02.15—Vacant”*

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 1.03
AWARD AND EXECUTION OF CONTRACT**

Replace Article 1.03.07 in its entirety with the following:

1.03.07—Insurance:

Coverage shall be on a primary basis.

The Contractor shall carry and maintain at all times during the term of the Contract the insurance coverages required by this Article and any additional coverages(s) or higher minimum insurance coverage amount(s) required by the Special Provisions of the Contract.

If the Project includes work on or adjacent to railroad property additional insurance may be required as specified by the railroad. Please refer to the Special Provisions for any additional insurance requirements by the railroad.

1. Worker's Compensation Insurance: With respect to all operations the Contractor performs and all those performed for it by subcontractors, the Contractor shall carry, and require each subcontractor to carry, Workers' Compensation insurance as required by the laws of the State of Connecticut.

Employer's Liability insurance shall be provided in amounts not less than \$100,000 per accident for bodily injury by accident; \$100,000 policy limit by disease and \$100,000 per employee for bodily injury by disease. Each Workers' Compensation policy shall contain the U.S. Longshoreman's and Harbor Workers' Act endorsement when work is to be performed over or adjacent to navigable water.

2. Commercial General Liability Insurance: With respect to the operations the Contractor performs and also those performed for it by subcontractors, the Contractor shall carry, and require each subcontractor to carry, Commercial General Liability insurance, including Contractual Liability, Products and Completed Operations, Broad Form Property Damage and Independent Contractors.

Products and completed operations insurance for ongoing and completed operations shall be maintained for a period of one (1) year after the acceptance of the project by the Department in accordance with Article 1.08.14. See chart below for applicable minimum coverage amounts.

Contract Amount (\$)	Minimum Single Occurrence Amount (\$)	Minimum Annual Aggregate Amount (\$)
0-2,000,000	1,000,000	2,000,000
>2,000,001-10,000,000	2,000,000	4,000,000
>10,000,000	4,000,000	8,000,000

In Facilities construction projects, if underground work is to be undertaken, each policy shall have coverage for and exclusions removed for “Explosion, Collapse and Underground” (“XCU”).

3. Automobile Liability Insurance: The Contractor shall obtain automobile liability insurance covering the operation of all motor vehicles, including those hired or borrowed, that are used in connection with the Project for all damages arising out of: (1) bodily injury to or death of all persons and/or (2) injury to or destruction of property; in any one accident or occurrence. This policy shall not be subject to an annual aggregate limitation. See chart above for applicable minimum coverage amounts.

4. Owner’s and Contractor’s Protective Liability Insurance for and in the Name of the State: With respect to the Contractor’s Project operations and also those of its subcontractors, the Contractor shall carry, for and on behalf of the State for each accident or occurrence resulting in damages from (1) bodily injury to or death of persons and/or (2) injury to or destruction of property. See chart below for applicable minimum coverage amounts.

Contract Amount (\$)	Minimum Single Occurrence Amount (\$)	Minimum Annual Aggregate Amount (\$)
0 - 20 Million	1,000,000	1,000,000
20 Million - 50 Million	2,000,000	2,000,000
> 50 Million	4,000,000	4,000,000

5. Railroad Protective Liability Insurance: When the Contract involves work within fifty (50) feet of the railroad right-of-way or State-owned rail property, with respect to Project operations and also those of its subcontractors, the Contractor shall carry Railroad Protective Liability Insurance providing coverage of at least \$2,000,000 for each accident or occurrence resulting in damages from (1) bodily injury to or death of all persons and/or (2) injury to or destruction of property, and subject to that limit per accident or occurrence, an aggregate coverage of at least \$6,000,000 for all damages during the policy period, and with all entities falling within any of the following listed categories named as insured parties: (i) the owner of the railroad right-of-way, (ii) the owner of any railcar licensed or permitted to travel within that affected portion of railroad right-of-way, and (iii) the operator of any railcar licensed or permitted to travel within that affected portion of the railroad right-of-way, and with the State, if not falling within any of the above-listed categories, also named as an insured party.

6. Blasting: When explosives are to be used in the Project, the Commercial General Liability insurance policy shall include XCU coverage, in the same limits as the per occurrence policy limits.

7. Protection and Indemnity Insurance for Marine Construction Operations in Navigable Waters:

If a vessel of any kind will be involved in Project work, the Contractor shall obtain the following additional insurance coverage:

A. Protection and Indemnity Coverage of at least \$300,000 per vessel or equal to at least the value of hull and machinery, whichever is greater.

B. If there is any limitation or exclusion with regard to crew and employees under the protection and indemnity form, the Contractor must obtain and keep in effect throughout the Project a workers' compensation policy, including coverage for operations under admiralty jurisdiction, with a limit of liability of at least \$300,000 per accident or a limit equal to at least the value of the hull and machinery, whichever is greater, or for any amount otherwise required by statute.

8. Builder's Risk Insurance: For Facilities construction projects, the Contractor shall maintain comprehensive replacement cost builder's risk (completed value) insurance providing coverage for the entire work at the Project site, including all fixtures, machinery and equipment, any heating, cooling and constituting a permanent part of the building and shall cover portions of work located away from the site, but intended for use at the site. If it is determined that all or a portion of the project is located within an area designated as a Special Flood Hazard Area, the Contractor shall maintain flood insurance (no less than \$10,000,000 sublimit). The State of Connecticut shall be named as Loss Payee. Equipment breakdown coverage may be sub limited to 50% of the project cost.

9. Architects and Engineer's Professional Liability Insurance for Structural Engineer: If required, limits will be specified in Article 1.03.07 of the Special Provisions of the Contract or Article 1.05.02.

10. Umbrella Liability Insurance: The Contractor may satisfy the minimum limits required for Commercial General Liability and Automobile Liability Insurance using Umbrella Liability Insurance. In the event that the Contractor obtains Umbrella Liability Insurance to meet the minimum coverage requirements for Commercial General Liability or Automobile Liability Insurance coverage, the Umbrella Liability Insurance policy shall have an annual aggregate at a limit not less than twice the single occurrence and must specifically endorse the State of Connecticut as an additional insured. Specifically for Bridge Projects with a low bid equal to or higher than \$80,000,000, the Umbrella Liability Insurance policy must have a minimum limit of at least \$25,000,000.

11. Certificate of Insurance: Before the Contract is executed, the Contractor must provide to the Department a certificate of insurance acceptable to the Commissioner and executed by an insurance company or companies satisfactory to the State of Connecticut for the insurance coverage(s) required by this Article and the Special

Provisions of the Contract. The Contractor shall maintain the required insurance coverage during the entire term of the Contract. The certificate of insurance must clearly include the name of the insured and identify the project for which it is being issued.

12. Copies of Policies: The Contractor shall provide, within five (5) business days, a copy or copies of all applicable insurance policies when requested by the State. In providing said policies, the Contractor may redact provisions of the policy that are proprietary. This provision shall survive the expiration or termination of the Contract.

13. Sovereign Immunity: The Contractor may not assert the defense of sovereign immunity in the adjustment of claims or in the defense of any claim or suit brought against the Contractor or the State, unless the State, in writing, requests that the Contractor do so or consents to its doing.

14. Contractor Assumes Costs: The Contractor shall assume and pay all costs and billings for premiums, deductibles, self-insured retentions and audit charges earned and payable under the required insurance.

15. State Named as Additional Insured: The State must be named as an additional insured party for the Commercial General Liability and Automobile Liability insurance policies required by this Article and the Special Provisions to the Contract, and any Umbrella Liability Insurance, as applicable, obtained in accordance with this Article. Each policy shall waive right of recovery (waiver of subrogation) against the State of Connecticut.

16. Termination or Change of Insurance:

A. The Contractor shall notify the Department of any cancelation of insurance carrier or change to the required insurance coverage by submitting a new insurance certificate to the Department immediately following said cancelation or change in required coverage.

B. It is the responsibility of the Contractor to maintain evidence of a current insurance coverage with the Department for the duration of contract. It is the responsibility of the Contractor to file with the Department all renewals and new certificates of insurance issued due to changes in policy terms or changes in insurance carriers prior to the expiration dates on the forms already on file with the Department.

17. Duration of Coverage. The Contractor shall keep all the required insurance in continuous effect until the date that the Department designates for the termination of the Contractor's responsibility, as defined by Article 1.08.14.

18. Compensation: There shall be no direct compensation allowed the Contractor on account of any premium or other charge necessary to obtain and keep in effect any insurance or bonds in connection with the Project, but the cost thereof shall be considered included in the general cost of the Project work.

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 1.05
CONTROL OF THE WORK**

In the list of Articles, replace

“1.05.02—Plans, Working Drawings and Shop Drawings”
with **“1.05.02—Plans, Working Drawings, Shop Drawings, Product Data, Submittal Preparation and Processing, and Designers Action”**

replace

“1.05.08—Vacant”
with **“1.05.08—Schedules and Reports”**

In the list of Articles, after 1.05.16—Dimensions and Measurements add
“1.05.17—Welding”

1.05.02—Plans, Working Drawings and Shop Drawings

Delete the entire Article and replace with the following:

1.05.02—Plans, Working Drawings, Shop Drawings, Product Data, Submittal Preparation and Processing, and Designers Action:

1. Plans: The plans prepared by the Department show the details necessary to give a comprehensive idea of the construction contemplated under the Contract. The plans will generally show location, character, dimensions, and details necessary to complete the Project. If the plans do not show complete details, they will show the necessary dimensions and details, which when used along with the other Contract documents, will enable the Contractor to prepare working drawings, shop drawings or product data necessary to complete the Project.

2. Working Drawings: When required by the Contract, or when ordered to do so by the Engineer, the Contractor shall prepare and submit six printed copies and one electronic copy in a pdf file format of the working drawings, signed, sealed and dated by a qualified Professional Engineer licensed to practice in the State of Connecticut, for review. The drawings shall be submitted to the Assistant District Engineer sufficiently in advance of the work detailed, to allow for their review in accordance with the review periods specified in Subarticle 1.05.02-5 (including any necessary revisions, resubmittal, and final review).

There will be no direct payment for furnishing any working drawings, procedures or supporting calculations, but the cost thereof shall be considered as included in the general cost of the work.

- a. Working Drawings for Permanent Construction: Drawings shall be submitted on 22 in x 34 in (559 mm x 864 mm) sheets with a border and title block similar to the Department standard. Calculations, procedures and other supporting data may be submitted in an 8-1/2 in x 11 in (216 mm x 279 mm) format.

The Contractor shall supply to the Assistant District Engineer a certificate of insurance in accordance with Article 1.03.07 at the time that the working drawings for the Project are submitted.

The Contractor's designer, who prepares the working drawings, shall secure and maintain at no direct cost to the State a Professional Liability Insurance Policy for errors and omissions in the minimum amount of \$2,000,000 per error or omission. The Contractor's designer may elect to obtain a policy containing a maximum \$250,000 deductible clause, but if the Contractor's designer should obtain a policy

containing such a clause, they shall be liable to the extent of at least the deductible amount. The Contractor's designer shall obtain the appropriate and proper endorsement of its Professional Liability Policy to cover the indemnification clause in this Contract, as the same relates to negligent acts, errors or omissions in the Project work performed by them. The Contractor's designer shall continue this liability insurance coverage for a period of (1) 3 years from the date of acceptance of the work by the Engineer, as evidenced by a State of Connecticut, Department of Transportation Form Number CON-500, entitled "Certificate of Acceptance of Work," issued to the Contractor; or (2) 3 years after the termination of the Contract, whichever is earlier, subject to the continued commercial availability of such insurance.

- b. Working Drawings for Temporary Construction: The Contractor shall submit drawings, calculations, procedures and other supporting data in a format acceptable to the Assistant District Engineer.

3. Shop Drawings: When required by the Contract, or when ordered to do so by the Engineer, the Contractor shall prepare and submit six printed copies and one electronic copy in a pdf file format of the shop drawings to the Designer for review. Review timeframes and submission locations are specified in Subarticle 1.05.02-5.

Drawings shall be submitted on 22 in x 34 in (559 mm x 864 mm) sheets with an appropriate border and with a title block in the lower right-hand corner of each sheet. Procedures and other supporting data may be submitted on 8½ in x 11 in (216 mm x 279 mm) sheets.

There will be no direct payment for furnishing any shop drawings, but the cost thereof shall be considered as included in the general cost of the work.

4. Product Data: When required by the Contract, or when ordered to do so by the Engineer, the Contractor shall prepare and submit six printed copies and one electronic copy in a pdf file format of the product data.

The product data shall be submitted to the Designer for review, sufficiently in advance of the work detailed, to allow for their review in accordance with the review periods specified in Subarticle 1.05.02-5 (including any necessary revisions, resubmittal, and final review), and acquisition of materials, without causing a delay of the Project.

The Contractor shall submit the product data in a single submittal for each element of construction.

The Contractor shall mark each copy of the product data submittal to show applicable choices and options. Where product data includes information on several products that are not required, copies shall be marked to indicate the applicable information. Product data shall include the following information and confirmation of conformance with the Contract to the extent applicable: manufacturer's printed recommendations, compliance with recognized trade association standards, compliance with recognized testing agency standards, application of testing agency labels and seals, notation of coordination requirements, Contract item number, and any other information required by the individual Contract provisions.

There will be no direct payment for furnishing any product data, but the cost thereof shall be considered as included in the general cost of the work.

5. Submittal Preparation and Processing – Review Timeframes: The Contractor shall allow 30 calendar days for submittal review by the Department, from the date of receipt of printed copies in the appropriate Designer or Engineer's office. For any submittals marked with "Revise and Resubmit" or "Rejected," the Department is allowed an additional 20 calendar days for review of any resubmissions.

An extension of Contract time will not be authorized due to the Contractor's failure to transmit submittals sufficiently in advance of the work to permit processing.

The furnishing of shop drawings, working drawings or product data, any comments or suggestions by the Designer or Engineer concerning shop drawings, working drawings or product data, shall not relieve the Contractor of any of its responsibility for claims by the State or by third parties, as per Article 1.07.10.

The furnishing of the shop drawings, working drawings and product data shall not serve to relieve the Contractor of any part of its responsibility for the safety or the successful completion of the Project construction.

Submissions: Unless otherwise defined in the Contract, the Contractor shall transmit the working drawings, shop drawings and product data as follows:

- (a) Working drawings for permanent construction, shop drawings, and product data shall be submitted to the Designer. A copy of the transmittal or cover letter shall be forwarded to the Assistant District Engineer of the administering Construction District.
- (b) Working drawings for temporary construction shall be submitted to the Assistant District Engineer of the administering Construction District.
- (c) If not provided in the Contract, the Contractor shall request a list detailing the delivery location and contact person for each type of submittal, from the administering Construction District.

6. Designers Action: The Designer or Engineer will review each submittal, mark each with a uniform, self-explanatory action stamp, and return the stamped submittal promptly to the Contractor. The Contractor shall not proceed with the part of the Project covered by the submittal until the submittal is marked "No Exceptions Noted" or "Exceptions as Noted" by the Designer or Engineer. The Contractor shall retain sole responsibility for compliance with all Contract requirements. The stamp will be marked as follows to indicate the action taken:

- (a) If submittals are marked "No Exceptions Noted," the Designer or Engineer has not observed any statement or feature that appears to deviate from the Contract requirements. This disposition is contingent on being able to execute any manufacturer's written warranty in compliance with the Contract provisions. The Contractor may proceed with the work covered in the submittal.
- (b) If submittals are marked "Exceptions as Noted" the considerations or changes noted by the Designer or Engineer are necessary in order for the submittal to comply with Contract requirements. The Contractor shall review the required changes and inform the Designer or Engineer if they feel the changes violate a provision of the Contract or would lessen the warranty coverage.
- (c) If submittals are marked "Revise and Resubmit," the Contractor shall revise the submittals to address the deficiencies or provide additional information as noted by the Designer or Engineer. The Contractor shall allow an additional review period as specified in Subarticle 1.05.02-5.
- (d) If submittals are marked "Rejected," the Contractor shall prepare and submit a new submittal in accordance with the Designer's or Engineer's notations. The resubmissions require an additional review and determination by the Designer or Engineer. The Contractor shall allow an additional review period as specified in Subarticle 1.05.02-5."

1.05.05—Cooperation by Contractor:

After the second paragraph, add the following:

" Voluntary Partnering: The Connecticut Department of Transportation ("Department") wants to establish a cohesive partnership with the Contractor and its principal subcontractors on the Project, so that the partnership can draw on the strengths of each organization in order to identify and pursue the partners' mutual Project goals. Chief among those will be the effective and efficient completion of the Project, within budget, on schedule, and in accordance with applicable plans, specifications, and other Contract provisions.

If the Contractor believes at any point before or during Project construction that the creation of formal partnering between itself and the Department, with the use of a third-party facilitator, would help the Contractor and the Department ("Partners") to reach these goals, the Contractor may submit a written request to the District Engineer of the District in which the Project will be constructed for the establishment of formal partnering between the Parties. If the Contractor makes such a request, the Department will engage in that partnering.

Any costs incurred by the Partners jointly in connection with Project partnering activities, to the extent that those costs are recognized as legitimate and appropriate by both

Partners, will be shared equally between them. Any other costs incurred because of partnering activities will be borne by the Partner that incurred them.

If the Contractor and the Department decide to pursue a formal partnering initiative, the Contractor and The Department will arrange first to meet in order to select a third-party partnering facilitator and to plan a partnering development and team-building workshop. After they agree upon the services to be performed by the facilitator and the range of compensation for the facilitator that would be acceptable to them, the Contractor will contract accordingly for the services of said facilitator. The Department will reimburse the Contractor for fifty percent (50%) of the payments made under that contract, so long as the activities paid for were appropriate and within the contemplation of the Partners.

At the Partners' initial partnering meeting, the Partners will also determine who should attend the first partnering workshop, what the workshop's agenda will be, how long the workshop should last, and when and where it will be held. Unless the Partners agree otherwise, attendance at the first partnering workshop will be mandatory for the Department's District Engineer for the Project and the Department's other key Project personnel, the Contractor's on-Site Project manager and other key supervisory Project personnel, and, if the Contractor agrees to it, the key supervisory personnel of the Contractor's principal Project subcontractors. The Partners will also request that the Project design engineers and key local government personnel send Regional/District and Corporate/State-level managers to the workshop and direct them to participate in Project partnering activities as and when requested to do so by the Partners.

With the agreement of the Partners, follow-up Project partnering workshops will be held periodically until the Department closes out the Contract.

If the Partners agree on a formal partnering charter for the Project, the establishment of that charter will not change the legal relationship of the Partners to the Contract; it will not alter, supplement, or eliminate any of the Partners' rights or obligations under the Contract."

1.05.08–Vacant:

Replace with the following:

“1.05.08—SCHEDULES AND REPORTS:

When a project coordinator is not required by the Contract the following shall apply:

Baseline Bar Chart Construction Schedule: Within 20 calendar days after contract award the Contractor shall develop a comprehensive bar chart as a baseline schedule for the project. The bar chart schedule shall be submitted to the Engineer for approval and shall be based on the following guidelines:

1. The bar chart schedule shall contain a list of activities that represents the major activities of the project. At a minimum, this list should include a breakdown by individual structure or stage, including major components of each. The bar chart schedule shall contain sufficient detail to describe the progression of the work in a comprehensive manner. As a guide, 10 to 15 bar chart activities should be provided for each \$1 million of contract value.

The following list is provided as an example only and is not meant to be all-inclusive or all-applicable:

Project Constraints

- Winter shutdowns
- Environmental permits/application time of year restrictions
- Milestones
- Third Party approvals

-Long lead time items (procurement and fabrication of major elements)

-Adjacent Projects or work by others

Award

Notice to Proceed

Signing (Construction, temporary, permanent by location)

Mobilization

Permits as required

Field Office

Utility Relocations

Submittals/shop drawings/working drawings/product data

Construction of Waste Stock pile area

Clearing and Grubbing

Earthwork (Borrow, earth ex, rock ex etc.)

Traffic control items (including illumination and signalization)

Pavement markings

Roadway Construction (Breakdown into components)

Drainage (Breakdown into components)

Culverts

Plantings (including turf establishment)

Semi-final inspection

Final Cleanup

As required the following may supplement the activities listed above for the specific project types indicated:

- a. For bridges and other structures, include major components such as abutments, wingwalls, piers, decks and retaining walls; further breakdown by footings, wall sections, parapets etc.

Temporary Earth Retention Systems

Cofferdam and Dewatering

Structure Excavation

Piles/test piles

Temporary Structures

Removal of Superstructure

Bearing Pads

Structural Steel (Breakdown by fabrication, delivery, installation, painting etc.)

Bridge deck

- b. Multiple location projects such as traffic signal, incident management, lighting, planting and guiderail projects will be broken down first by location and then by operation. Other major activities of these types of projects should include, but are not limited to:

Installation of anchors

Driving posts

Foundations

Trenching and Backfilling

Installation of Span poles/mast arms

Installation of luminaries

Installation of cameras
Installation of VMS
Hanging signal heads
Sawcut loops
Energizing equipment

- c. Facility Projects – Facilities construction shall reflect the same breakdown of the Project as the Schedule of Values:

Division 2 – Existing Conditions
Division 3 – Concrete
Division 4 – Masonry
Division 5 – Metals
Division 6 – Wood, Plastic, and Composites
Division 7 – Thermal and Moisture Protection
Division 8 – Openings
Division 9 – Finishes
Division 10 – Specialties
Division 11 – Equipment
Division 12 - Furnishings
Division 13 – Special Construction
Division 14 – Conveying Equipment
Division 21 – Fire Suppression
Division 22 – Plumbing
Division 23 – Heating, Ventilating, and Air Conditioning
Division 26 – Electrical
Division 27 – Communications
Division 28 – Electronic Safety and Security
Division 31 – Earthwork
Division 32 – Exterior Improvements
Division 33 - Utilities

2. If the Engineer determines that additional detail is necessary, the Contractor shall provide it.

3. Each activity shall have a separate schedule bar. The schedule timeline shall be broken into weekly time periods with a vertical line to identify the first working day of each week.

4. The bar chart schedule shall show relationships among activities. The critical path for the Project shall be clearly defined on the schedule. The schedule shall show milestones for major elements of work, and shall be prepared on a sheet, or series of sheets of sufficient width to show data for the entire construction period.

5. If scheduling software is used to create the bar chart schedule, related reports such as a predecessor and successor report, a sort by total float, and a sort by early start shall also be submitted.

6. Project activities shall be scheduled to demonstrate that the construction completion date for the Project will occur prior to expiration of the Contract time. In addition, the schedule shall demonstrate conformance with any other dates stipulated in the Contract.

7. The Contractor is responsible to inform its subcontractor(s) and supplier(s) of the project schedule and any relevant updates.

8. There will be no direct payment for furnishing schedules, the cost thereof shall be considered as included in the general cost of the work.

9. For projects without a Mobilization item, 5% of the contract value will be withheld until such time as the Baseline Schedule is approved.

Monthly Updates: No later than the 10th day of each month, unless directed otherwise by the Engineer, the Contractor shall deliver to the Engineer three copies of the schedule to show the work actually accomplished during the preceding month, the actual time spent on each activity, and the estimated time needed to complete any activity which has been started but not completed. Each time bar shall indicate, in 10% increments, the estimated percentage of that activity which remains to be completed. As the Project progresses, the Contractor shall place a contrasting mark in each bar to indicate the actual percentage of the activity that has been completed.

The monthly update shall include revisions of the schedule necessitated by revisions to the Project directed by the Engineer (including, but not limited to extra work), during the month preceding the update. Similarly, any changes of the schedule required due to changes in the Contractor's planning or progress shall also be included. The Engineer reserves the right to reject any such revisions. If the schedule revisions extend the contract completion date, due to extra or added work or delays beyond the control of the Contractor, the Contractor shall submit a request in writing for an extension of time in accordance with Article 1.08.08. This request shall be supported by an analysis of the schedules submitted previously.

Any schedule revisions shall be identified and explained in a cover letter accompanying the monthly update. The letter shall also describe in general terms the progress of the Project since the last schedule update and shall identify any items of special interest.

If the Contractor fails to provide monthly schedule updates, the Engineer has the right to hold 10% of the monthly estimated payment, or \$5,000, whichever is less, until such time as an update has been provided in accordance with this provision.

Biweekly Schedules: Each week, the Contractor shall submit to the Engineer a two week look-ahead schedule. This short-term schedule may be handwritten but shall clearly indicate all work planned for the following two week period.

Recovery Schedules: If the updated schedule indicates that the Project has fallen behind schedule, the Contractor shall either submit a time extension request in accordance with 1.08.08 or immediately institute steps acceptable to the Engineer to improve its progress of the Project. In such a case, the Contractor shall submit a recovery plan, as may be deemed necessary by the Engineer, to demonstrate the manner in which an acceptable rate of progress will be regained."

Article 1.05.12–Payrolls:

Replace the first paragraph with the following:

" For each week of the Project from the first week during which an employee of the Contractor does Project work to which prevailing wage requirements apply, until the last week on which such an employee does such work, the Contractor shall furnish to the Engineer certified copies of payrolls showing:

- (a) the names of the employees who worked on the Project and whose work is subject to prevailing wage requirements,
- (b) the specific days and hours and numbers of hours that each such employee worked on the Project, and
- (c) the amount of money paid to each such employee for Project work.

Each such payroll shall include the statement(s) of compliance with prevailing wage laws required by the State of Connecticut and, if applicable, by the Federal government. Said payrolls must contain all information required by Connecticut General Statutes Section 31-53 (as it may be revised). For contracts subject to Federal prevailing wage requirements, each payroll shall also contain the information required by the Davis Bacon and Related Acts (DBR). All of the payroll requirements in this Article shall also apply to the work of any subcontractor or other party that performs work on the Project site, and the Contractor shall be responsible for ensuring that each such party meets said requirements.”

Article 1.05.15–Markings for Underground Facilities:

Replace the beginning of the first sentence with the following:

“In conformance with Sections 16-345 through 16-359 of the Regulations of the PURA state statutes, the Contractor is responsible for notifying ‘Call Before You Dig’ ...”

After Article 1.05.16–Dimensions and Measurements, add the following article:

“1.05.17 - WELDING

The Contractor shall ensure that all welding of materials permanently incorporated into the work, and welding of materials used temporarily during construction of the work is performed in accordance with the following codes:

- American Welding Society (AWS) Structural Welding Code – Steel – ANSI/AWS D1.1: Miscellaneous steel items that are statically loaded including but not limited to columns, and floor beams in buildings, railings, sign supports, cofferdams, tubular items, and modifications to existing statically loaded structures.
- AWS Structural Welding Code – Aluminum – AWS D1.2/D1.2M: Any aluminum structure or member including but not limited to brackets, light standards, and poles.
- AWS Structural Welding Code – Sheet Steel – AWS D1.3/D1.3M: Sheet steel and cold-formed members 0.18 in.(4.6 mm) or less in thickness used as, but not limited, to decking and stay-in-place forms.
- AWS Structural Welding Code – Reinforcing Steel – AWS D1.4/D1.4M: Steel material used in the reinforcement of cast-in-place or pre-cast Portland cement concrete elements including but not limited to bridge decks, catch basin components, walls, beams, deck units, and girders.
- AASHTO/AWS – Bridge Welding Code, AASHTO/AWS D1.5/D1.5M: Steel highway bridges and other dynamically loaded steel structures. Also includes sign supports, and any other fracture critical structure.

The edition governing the work shall be in effect on the date the Contract was advertised for solicitation of bids.

The Contractor is responsible to provide a Certified Welding Inspector in accordance with the above noted codes. The cost for this service is included in the general cost of the work.

All welders shall be certified by the Engineer in accordance with Section 6.03.”

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 1.07
LEGAL RELATIONS AND RESPONSIBILITIES**

In the list of Articles, change “1.07.07 – Public Convenience and Safety” to “1.07.07 – Safety and Public Convenience.”

1.07.05 – Load Restrictions

Delete the entire article and replace with the following:

“1.07.05 – Load Restrictions

(a) Vehicle Weights: This subarticle will apply to travel both on existing pavements and pavements under construction. The Contractor shall comply with all legal load restrictions as to vehicle size, the gross weight of vehicles, and the axle weight of vehicles while hauling materials. Throughout the duration of the contract, the Contractor shall take precautions to ensure existing and newly installed roadway structures and appurtenances are not damaged by construction vehicles or operations.

Unless otherwise noted in contract specifications or plans, on and off road equipment of the Contractor, either loaded or unloaded, will not be allowed to travel across any bridge or on any highway when such a vehicle exceeds the statutory limit or posted limit of such bridge or highway. Should such movement of equipment become necessary the Contractor shall apply for a permit from the Department for such travel, as provided in the Connecticut General Statutes (CGS). The movement of any such vehicles within the project limits or detour routes shall be submitted to the Engineer for project record. Such permit or submittal will not excuse the Contractor from liability for damage to the highway caused by its equipment.

The Contractor is subject to fines, assessments and other penalties that may be levied as a result of violations by its employees or agents of the legal restrictions as to vehicle size and weight.

(b) Storage of Construction Materials/Equipment on Structures: Storage is determined to be non-operating equipment or material. The Contractor shall not exceed the statutory limit or posted limit for either an existing or new structure when storing materials and/or construction equipment. When a structure is not posted, then the maximum weight of equipment or materials stored in each 12 foot wide travel lane of any given span shall be limited to 750 pounds per linear foot combined with a 20,000 pound concentrated load located anywhere within the subject lane. If anticipated storage of equipment or material exceeds the above provision, then the Contractor shall submit his proposal of storage supported by calculations stamped by a Professional Engineer registered in the State of Connecticut, to the Engineer for approval 14 days prior to the storage operation. Operations related to structural steel demolition or erection shall follow the guidelines under Section 6.03. All other submittals shall include a detailed description of the material/equipment to be stored, the quantity of storage if it is stockpiled materials, the storage location, gross weight with supporting calculations if applicable, anticipated duration of storage and any environmental safety, or traffic protection that may be required. Storage location on the structure shall be clearly defined in the field. If structures are in a state of staged construction or demolition, additional structural analysis may be required prior to authorization of storage.”

1.07.07 – Safety and Public Convenience

*Change the title of Article 1.07.07 to read “**1.07.07 – Safety and Public Convenience**” and change the last sentence of the seventh paragraph to read as follows:*

“The Contractor must make available for reference in its field office, throughout the duration of the Project, a copy of the Safety Plan and the latest edition, including all supplements, of the CFR pertaining to OSHA.”

After the ninth paragraph insert the following:

“ Before beginning work on the Project, the Contractor shall have a Safety Plan on file with the Department. The Safety Plan shall include the policies and procedures necessary for the Contractor to comply with OSHA and other pertinent regulatory rules, regulations and guidelines. The Safety Plan may be a comprehensive company-wide plan provided it addresses the scope and type of work contemplated by the Contract. The Safety Plan shall address all the requirements of this Section and any applicable State or Federal regulations, and shall be revised and updated as necessary.

The following elements shall be included in the Safety Plan:

1. General introduction describing the scope and applicability of the Safety Plan.
2. Identification of key staff responsible for the implementation and monitoring of the Contractor’s Safety Plan, and their roles and responsibilities for safety.
3. Training requirements relative to safety.
4. Safety rules and checklists specific to the types of work generally performed by the Contractor.
5. Record-keeping and reporting requirements.
6. Identification of special hazards related to specific work elements.

The Contractor is responsible for the Safety Plan. Pursuant to Article 1.07.10, the Contractor shall indemnify, and save harmless the State from any and all liability related to any violation of the Safety Plan.”

1.07.18 – Use of State Property

After Subarticle (h) add the following sentence:

“Gore areas are not available for disposal of surplus material.”

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 1.08
PROSECUTION AND PROGRESS**

1.08.01 – Transfer of Work or Contract:

Replace the last paragraph with the following paragraphs:

“ The Contractor shall not sublet, sell, transfer, assign, or otherwise dispose of the Contract or any portion thereof, or of the work provided for therein, or of its right, title, or interest therein, to any individual or entity without the written consent of the Commissioner. No payment will be made for such work until written consent is provided by the Commissioner.

The Contractor shall pay the subcontractor for work performed within thirty (30) days after the Contractor receives payment for the work performed by the subcontractor. Withholding retainage by the Contractor, subcontractor or lower tier subcontractors is not allowed.

Payment for work that has been performed by a subcontractor does not eliminate the Contractor’s responsibilities for all the work as defined in Article 1.07.12, “Contractor’s Responsibility for Work.”

Payment for work that has been performed by a subcontractor also does not release the subcontractor from its responsibility for maintenance and other periods of subcontractor responsibility specified for the subcontractor’s items of work. Failure of a subcontractor to meet its maintenance, warranty or defective work responsibilities may result in administrative action on future Department contracts.

For any dispute regarding prompt payment, the alternate dispute resolution provisions of this article shall apply.

The above requirements are also applicable to all sub-tier subcontractors and the above provisions shall be made a part of all subcontract agreements.

Failure of the Contractor to comply with the provisions of this section may result in a finding that the Contractor is nonresponsive as a bidder for a Department contract.”

1.08.07 – Determination of Contract Time:

Replace the first paragraph with the following:

“ Unless the Contract requires the Project completion by a specified date, the number of calendar days allowed for the completion of the Project will be fixed by the Department, will be stated in the Contract, and will be known (with any subsequent adjustments) as the “Contract time.” If at any time the Contractor submits a schedule showing completion of the work more than 30 calendar days in advance of the Contract completion date, the Department will issue a no-cost construction order revising the allowable Contract time to that shown on the Contractor's schedule.”

Replace the fifth paragraph with the following:

“ The total elapsed time in calendar days, computed as described above, from the commencement date specified in the Engineer's "Notice to Proceed" to the “Substantial Completion” date specified in the Engineer's "Notice of Substantial Completion" shall be considered as the time used in the performance of the Contract work.”

1.08.09 – Failure to Complete Work on Time:

Replace the second paragraph with the following:

“ If the last day of the initial Contract time or the initial Contract date determined for Substantial Completion is before December 1 in the given year, liquidated damages as specified in the Contract shall be assessed against the Contractor per calendar day (including any days during a winter shutdown period) from that day until the date on which the Project is substantially completed.”

1.08.12—Final Inspection:

Replace the first paragraph with the following:

“ If the Engineer determines that the work may be substantially complete, a Semi Final Inspection will be held as soon as practical. After the Semi Final Inspection is held and the Engineer determines that the requirements for Substantial Completion have been satisfied the Engineer will prepare a “Notice of Substantial Completion”.

When the Contractor has completed all work listed in the “Notice of Substantial Completion” the Contractor shall prepare a written notice requesting a Final Inspection and a “Certificate of Acceptance of Work”. The Engineer will hold an Inspection of the Project as soon as practical after the Engineer determines that the Project may be completed. If the Engineer deems the Project complete, said inspection shall constitute the Final Inspection, and the Engineer will notify the Contractor in writing that the Final Inspection has been performed.”

1.08.13 – Acceptance of Work and Termination of the Contractor’s Responsibility:

Replace the only paragraph with the following:

“ The Contractor’s responsibility for non-administrative Project work will be considered terminated when the final inspection has been held, any required additional work and final cleaning-up have been completed, all final operation and maintenance manuals have been submitted, and all of the Contractor’s equipment and construction signs have been removed from the Project site. When these requirements have been met to the satisfaction of the Engineer, the Commissioner will accept the work by certifying in writing to the Contractor that the non-administrative Project work has been completed.”

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 1.09
MEASUREMENT AND PAYMENT**

1.09.04 – Extra and Cost-Plus Work

Delete the word “bonding” under section (a) Labor, (3).

Delete existing subarticle (e) and replace with the following:

“(e) Administrative Expense: When extra work on a cost-plus basis is performed by an authorized subcontractor, the Department will pay the Contractor an additional 7.5% for that work; such payment will be in addition to the percentage payments described in (a), (b), (c) and (d) above, as a reimbursement for the Contractor's administrative expense in connection with such work. Approval of such additional payments will be given only after the Contractor provides to the Engineer receipted invoices for all relevant costs.”

1.09.06 – Partial Payments:

In the first paragraph under A. Monthly and Semi-monthly Estimates:, delete the second, third and fourth sentences and replace the remainder of subarticle (1) with the following:

“Retainage will not be held.

Exceptions may be made as follows:

- (a) When not in conflict with the interests of the State, the Contractor may request, and the Engineer may make, semi-monthly estimates for payment.
- (b) If, in the judgment of the Assistant District Engineer, the Project is not proceeding in accordance with the Contract the Engineer may decline to make a payment estimate.
- (c) If the total value of the Project work complete since the last estimate amounts to less than \$2,500 the Engineer also may decline to make a payment estimate.”

Replace the first paragraph of subarticle B. Payment for Stored Materials: with the following:

“B. Payment for Stored Materials: Non-perishable materials that are required for Project construction and that the Contractor has produced or purchased specifically for incorporation into the Project, but which have not yet been so incorporated, may be included in a payment estimate if

- (i) the materials meet all applicable Contract specifications,
- (ii) the materials have been delivered to the Project site or to another location approved by the Engineer, and

(iii) the Contractor has submitted to the Engineer, as evidence of the Contractor's purchase of the materials, either a copy of a receipted bill for same or a Certificate of Title to the materials, in the form approved by the Department, duly-executed by the Contractor and Vendor.

The Engineer will decide at what fair and appropriate fraction of the applicable Contract price such materials may be included in a payment estimate."

1.09.07 – Final Payment:

Replace the entire article with the following:

"1.09.07 – Final Payment: When the Commissioner has accepted the Project in accordance with Article 1.08.14, the Engineer will prepare a final payment estimate."

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 1.10
ENVIRONMENTAL COMPLIANCE**

Add the following Article:

“1.10.08 – VEHICLE EMISSIONS

All motor vehicles and/or construction equipment (both on-highway and off-road) shall comply with all pertinent State and Federal regulations relative to exhaust emission controls and safety.

The Contractor shall establish staging zones for vehicles that are waiting to load or unload at the contract area. Such zones shall be located where the emissions from the vehicles will have minimum impact on abutters and the general public.

Idling of delivery trucks, dump trucks, and other equipment shall not be permitted in excess of 3 minutes during periods of non-activity except as allowed by the Regulations of Connecticut State Agencies Section 22a-174-18(b)(3)(c):

No mobile source engine shall be allowed to operate for more than three (3) consecutive minutes when the mobile source is not in motion, except as follows:

- (i) When a mobile source is forced to remain motionless because of traffic conditions or mechanical difficulties over which the operator has no control,
- (ii) When it is necessary to operate defrosting, heating or cooling equipment to ensure the safety or health of the driver or passengers,
- (iii) When it is necessary to operate auxiliary equipment that is located in or on the mobile source to accomplish the intended use of the mobile source,
- (iv) To bring the mobile source to the manufacturer's recommended operating temperature,
- (v) When the outdoor temperature is below twenty degrees Fahrenheit (20 degrees F) [negative seven degrees Celsius (-7 degrees C)],
- (vi) When the mobile source is undergoing maintenance that requires such mobile source be operated for more than three (3) consecutive minutes, or
- (vii) When a mobile source is in queue to be inspected by U.S. military personnel prior to gaining access to a U.S. military installation.

All work shall be conducted to ensure that no harmful effects are caused to adjacent sensitive receptors. Sensitive receptors include but are not limited to hospitals, schools, daycare facilities, elderly housing and convalescent facilities. Engine exhaust shall be located away from fresh air intakes, air conditioners, and windows.

A Vehicle Emissions Mitigation plan will be required for areas where extensive work will be performed within (less than 50 feet (15 meters)) to sensitive receptors. No work will proceed until a sequence of construction and a Vehicle Emissions Mitigation plan is submitted in writing to the Engineer for review and all comments are addressed in a manner acceptable to the Engineer. The mitigation plan must address the control of vehicle emissions from all vehicles and construction equipment.

Any costs associated with this "Vehicle Emissions" article shall be included in the general cost of the Contract. In addition, there shall be no time granted to the contractor for compliance with this notice. The contractor's compliance with this notice and any associated regulations shall not be grounds for claims as outlined in Section 1.11 – "Claims."

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 1.11
CLAIMS**

Add the following Section:

**SECTION 1.11
CLAIMS**

1.11.01 – General

1.11.02 – Notice of Claim

1.11.03 – Record Keeping

1.11.04 – Claim Compensation

1.11.05 – Required Claim Documentation

1.11.06 – Auditing of Claims

1.11.01 – General: When filing a formal claim under Section 4-61 (referred to as “Section 4-61” below) of the C.G.S. (as revised), either as a lawsuit in the Superior Court or as a demand for arbitration, the Contractor must follow the procedures and comply with the requirements set forth in this Section of the Specifications. This Section does not, unless so specified, govern informal claims for additional compensation which the Contractor may bring before the Department. The Contractor should understand, however, that the Department may need, before the Department can resolve such a claim, the same kinds of documentation and other substantiation that it requires under this Section. It is the intent of the Department to compensate the Contractor for actual increased costs caused by or arising from acts or omissions on the part of the Department that violate legal or contractual duties owed to the Contractor by the Department.

1.11.02 – Notice of Claim: Whenever the Contractor intends to file a formal claim against the Department under Section 4-61, seeking compensation for additional costs, the Contractor shall notify the Commissioner in writing (in strict compliance with Section 4-61) of the details of said claim. Such written notice shall contain all pertinent information described in Article 1.11.05 below.

Once formal notice of a claim under C.G.S. Section 4-61 (b) (as revised) has been given to the Commissioner, the claimant may not change the claim in any way, in either concept or monetary amount, (1) without filing a new notice of claim and demand for arbitration to reflect any such change and (2) without the minimum period of six months after filing of the new demand commencing again and running before any hearing on the merits of the claim may be held. The only exception to this limitation will be for damages that continue to accrue after submission of the notice, in ways described and anticipated in the notice.

1.11.03 – Record Keeping: The Contractor shall keep daily records of all costs incurred in connection with its construction-related activities on behalf of the Department. These daily records shall identify each aspect of the Project affected by

matters related to any claim for additional compensation that the Contractor has filed, intends to file, or has reason to believe that it may file against the Department; the specific Project locations where Project work has been so affected; the number of people working on the affected aspects of the Project at the pertinent time(s); and the types and number of pieces of equipment on the Project site at the pertinent time(s). If possible, any potential or anticipated effect on the Project's progress or schedule which may result in a claim by the Contractor should also be noted contemporaneously with the cause of the effect, or as soon thereafter as possible.

1.11.04 – Claim Compensation: The payment of any claim, or any portion thereof, that is deemed valid by the Engineer shall be made in accordance with the following provisions of this Article:

(a) Compensable Items: The liability of the Department for claims will be limited to the following specifically-identified items of cost, insofar as they have not otherwise been paid for by the Department, and insofar as they were caused solely by the actions or omissions of the Department or its agents (except that with regard to payment for extra work, the Department will pay to the Contractor the mark-ups provided for in Article 1.04.05.):

- (1) Additional Project-site labor expenses.
- (2) Additional costs for materials.
- (3) Additional, unabsorbed Project-site overhead (**e.g.**, for mobilization and demobilization).
- (4) Additional costs for active equipment.
- (5) For each day of Project delay or suspension caused solely by actions or omissions of the Department, either
 - (i) an additional ten percent (10%) of the total amount of the costs identified in Subarticles (1) through (4) above; except that if the delay or suspension period prevented the Contractor from incurring enough Project costs under Subarticles (1) through (4) during that period to require a payment by the Department that would be greater than the payment described in subparagraph (ii) below, then the payment for affected home office overhead and profit shall instead be made in the following *per diem* amount:
 - (ii) six percent (6%) of the original total Contract amount divided by the original number of days of Contract time.

Payment under either (i) or (ii) hereof shall be deemed to be complete and mutually-satisfactory compensation for any unabsorbed home office overhead and any profit related to the period of delay or suspension.

- (6) Additional equipment costs. Only actual equipment costs shall be used in the calculation of any compensation to be made in response to claims for additional Project compensation. Actual equipment costs shall be based upon records kept in the normal course of business and in accordance with generally-accepted accounting principles. Under no circumstances shall Blue Book or other guide or rental rates be used for this purpose (unless the Contractor had to rent the equipment from an unrelated party, in which case the actual rental charges paid by the Contractor, so long as they are reasonable, shall be used). Idle equipment, for instance, shall be paid for based only on its actual cost to the Contractor.

- (7) Subcontractor costs limited to, and determined in accordance with, Subarticles (1), (2), (3), (4), and (5) above and applicable statutory and case law. Such subcontractor costs may be paid for by the Department only (a) in the context of an informal claims settlement or (b) if the Contractor has itself paid or legally-assumed, present unconditional liability for those subcontractor costs.

(b) Non-Compensable Items: The Department will have no liability for the following specifically-identified non-compensable items:

- (1) Profit, in excess of that provided for herein.
- (2) Loss of anticipated profit.
- (3) Loss of bidding opportunities.
- (4) Reduction of bidding capacity.
- (5) Home office overhead in excess of that provided for in Article 1.11.04(a)(5) hereof.
- (6) Attorneys fees, claims preparation expenses, or other costs of claims proceedings or resolution.
- (7) Any other consequential or indirect expenses or costs, such as tort damages, or any other form of expense or damages not provided for in these Specifications or elsewhere in the Contract.

1.11.05 – Required Claim Documentation: All claims shall be submitted in writing to the Commissioner, and shall be sufficient in detail to enable the Engineer to ascertain the basis and the amount of each claim, and to investigate and evaluate each claim in detail. As a minimum, the Contractor must provide the following information for each and every claim and sub-claim asserted:

- (a) A detailed factual statement of the claim, with all dates, locations and items of work pertinent to the claim.
- (b) A statement of whether each requested additional amount of compensation or extension of time is based on provisions of the Contract or on an alleged breach of the Contract. Each supporting or breached Contract provision and a statement of the reasons why each such provision supports the claim, must be specifically identified or explained.
- (c) Excerpts from manuals or other texts which are standard in the industry, if available, that support the Contractor's claim.
- (d) The details of the circumstances that gave rise to the claim.
- (e) The date(s) on which any and all events resulting in the claim occurred, and the date(s) on which conditions resulting in the claim first became evident to the Contractor.
- (f) Specific identification of any pertinent document, and detailed description of the substance of any material oral communication, relating to the substance of such claim.
- (g) If an extension of time is sought, the specific dates and number of days for which it is sought, and the basis or bases for the extension sought. A critical path method, bar chart, or other type of graphical schedule that supports the extension must be submitted.
- (h) When submitting any claim over \$50,000, the Contractor shall certify in writing, under oath and in accordance with the formalities required by the contract, as to the following:
 - (1) That supporting data is accurate and complete to the Contractors best

- knowledge and belief;
- (2) That the amount of the dispute and the dispute itself accurately reflects what the Contractor in good faith believes to be the Department's liability;
 - (3) The certification shall be executed by:
 - a. If the Contractor is an individual, the certification shall be executed by that individual.
 - b. If the Contractor is not an individual, the certification shall be executed by a senior company official in charge at the Contractor's plant or location involved or an officer or general partner of the Contractor having overall responsibility for the conduct of the Contractor's affairs.

1.11.06 – Auditing of Claims: All claims filed against the Department shall be subject to audit by the Department or its agents at any time following the filing of such claim. The Contractor and its subcontractors and suppliers shall cooperate fully with the Department's auditors. Failure of the Contractor, its subcontractors, or its suppliers to maintain and retain sufficient records to allow the Department or its agents to fully evaluate the claim shall constitute a waiver of any portion of such claim that cannot be verified by specific, adequate, contemporaneous records, and shall bar recovery on any claim or any portion of a claim for which such verification is not produced. Without limiting the foregoing requirements, and as a minimum, the Contractor shall make available to the Department and its agents the following documents in connection with any claim that the Contractor submits:

- (1) Daily time sheets and foreman's daily reports.
- (2) Union agreements, if any.
- (3) Insurance, welfare, and benefits records.
- (4) Payroll register.
- (5) Earnings records.
- (6) Payroll tax returns.
- (7) Records of property tax payments.
- (8) Material invoices, purchase orders, and all material and supply acquisition contracts.
- (9) Materials cost distribution worksheets.
- (10) Equipment records (list of company equipment, rates, etc.).
- (11) Vendor rental agreements
- (12) Subcontractor invoices to the Contractor, and the Contractor's certificates of payments to subcontractors.
- (13) Subcontractor payment certificates.
- (14) Canceled checks (payroll and vendors).
- (15) Job cost reports.
- (16) Job payroll ledger.
- (17) General ledger, general journal (if used), and all subsidiary ledgers and journals, together with all supporting documentation pertinent to entries made in these ledgers and journals.
- (18) Cash disbursements journals.
- (19) Financial statements for all years reflecting the operations on the Project.
- (20) Income tax returns for all years reflecting the operations on the Project.
- (21) Depreciation records on all company equipment, whether such records are maintained by the company involved, its accountant, or others.

- (22) If a source other than depreciation records is used to develop costs for the Contractor's internal purposes in establishing the actual cost of owning and operating equipment, all such other source documents.
- (23) All documents which reflect the Contractor's actual profit and overhead during the years that the Project was being performed, and for each of the five years prior to the commencement of the Project.
- (24) All documents related to the preparation of the Contractor's bid, including the final calculations on which the bid was based.
- (25) All documents which relate to the claim or to any sub-claim, together with all documents that support the amount of damages as to each claim or sub-claim.
- (26) Worksheets used to prepare the claim, which indicate the cost components of each item of the claim, including but not limited to the pertinent costs of labor, benefits and insurance, materials, equipment, and subcontractors' damages, as well as all documents which establish the relevant time periods, individuals involved, and the Project hours and the rates for the individuals.
- (27) The name, function, and pertinent activity of each Contractor's or subcontractor's official, or employee involved in or knowledgeable about events that give rise to, or facts that relate to, the claim.
- (28) The amount(s) of additional compensation sought and a break-down of the amount(s) into the categories specified as payable under Article 1.11.04 above.
- (29) The name, function, and pertinent activity of each Department official, employee or agent involved in or knowledgeable about events that give rise to, or facts that relate to, the claim.

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 1.20
GENERAL CLAUSES FOR FACILITIES CONSTRUCTION**

1.20-1.00 – General:

Delete the last sentence of the first paragraph and replace with the following:

“Facilities Construction is defined as the type of construction that requires the issuance of a Certificate of Compliance (C.O.C.) by the State Building Inspector or his authorized representative at the completion of a project, and includes site work considered ancillary to this type of construction.”

Add the following article:

“1.20-1.01.01—Definitions:

OWNER: Where used herein, it is synonymous with Department or State.”

1.20-1.02.04 – Examination of Plans, Specifications, Special Provisions and Site of Work:

Delete the first sentence of the first paragraph and replace with the following:

“CSI-formatted specifications are organized into Divisions and Sections based on the CSI’s “MasterFormat” numbering system.”

1.20-1.02.13 – Knowledge of Applicable Laws:

Delete Items 1 through 9 in their entirety and replace with the following:

1. “The 2003 International Building Code with the State Building Code, including latest Connecticut Supplement and Amendments.
2. The 2003 International Plumbing Code.
3. The 2003 International Mechanical Code.
4. The 2003 International Existing Building Code.
5. The 2009 International Energy Conservation Code.
6. The 2011 NFPA 70 National Electrical Code.
7. The 2003 ICC/ANSI A117.1.
8. The Fire Safety Code, including latest Connecticut Supplement and Amendments.
9. The 2003 International Fire Code.
10. The 2003 NFPA 1 Uniform Fire Code.

11. The 2003 NFPA 101 Life Safety Code.”

Add the following as the new last paragraph:

“All work to be performed by the Contractor shall comply with the “Americans with Disabilities Act Accessibility Guidelines.””

1.20-1.03.01 – Consideration of Bids:

Delete the entire article and replace with the following:

“The apparent low bidder shall submit to the Manager of Contracts a Schedule of Values within 14 days after bid opening. Any other Contractor that the Department may subsequently designate as the apparent lowest bidder shall make the aforesaid submission within 14 days from the date on which the Department notifies said Contractor that it has become the apparent lowest bidder. If, however, the Department deems it necessary for such a subsequently designated Contractor to make said submission within a shorter period of time, the Contractor shall make the submission within the time designated by the Department.

The total in the Schedule of Values shall equal the bid dollar amount for the Major Lump Sum Item (MLSI).

The Schedule of Values shall be divided into “Line Items” listed separately for each CSI Section of the Special Provisions. An additional line item for “Mobilization” shall be incorporated into the Schedule of Values; however, this item may not exceed 7.5% of the value of the MLSI. The “Mobilization” line item will also include costs associated with “General Conditions” and “Insurance/Bonding.” An additional line item for “Project Closeout” shall be incorporated into the Schedule of Values; however, this item must be at least 2.5% of the value of the MLSI. Where requested by the Department, the Contractor shall break down the line items further into more specific line items.

In the event that this Contract is terminated or a portion of this Contract is deleted for any reason or in any way allowable by law under this Contract after the apparent low bidder has been awarded the Contract, the Schedule of Values will not be used for estimating payment due the Contractor for work completed prior to such termination of the Contract or deletion of work thereunder. In the case of Contract termination, payment shall be made in accordance with Article 1.05.14.”

1.20-1.05.02--Shop Drawings, Product Data, Product Samples and Quality Assurance Submittals:

Delete the last sentence of the first paragraph and replace with the following:

“All facsimiles or other electronic documents from the Contractor shall be followed by an

official transmittal.”

Delete the third paragraph and replace with the following:

“The Contractor shall number each submittal consecutively: When resubmitting a “Revise and Resubmit” or “Rejected” submittal, the Contractor shall label the transmittal with the original submittal number followed by a letter to designate the additional submission. All submittals shall be numbered conforming to the following examples:”

In column B of line 001, line 001a, and line 001b of the table in subsection 1, replace “07511” with “075110.”

Add the following to the end of the first paragraph of subsection 2:

“The Department reserves the right to return partial submittals unreviewed to the Contractor.”

Revise the third paragraph of subsection 2 to read:

“The Contractor shall allow at least 60 calendar days for review of any submittal requiring approval by FAA, FTA, any railroad, DEEP, U.S. Coast Guard, Army Corps of Engineers, or any other outside agency.”

Delete the third and fourth paragraphs of subsection 3 and replace with the following:

“The Designer will not review submittals and the Engineer will not process payment estimates until the initial submittal schedule has been provided. Any delays in construction due to the Contractor's failure to provide a submittal schedule shall be the responsibility of the Contractor.

The Contractor must update its submittal schedule at least once a month, and distribute and post each updated schedule in the manner described above. The Engineer reserves the right not to process payment estimates without a recently updated submittal schedule on file.”

Replace the first sentence of the first paragraph of subsection 4 with the following:

“Shop Drawings consist of fabrication and installation drawings, roughing-in and setting drawings, schedules, patterns, templates and similar drawings, and wiring diagrams showing field-installed wiring, including power, signal, and control wiring.”

Replace the second paragraph of subsection 4 with the following:

“Shop drawings shall include the following information: Contract number, Project

description, number and title of the drawing, date of drawing, revision number, name of Contractor and subcontractor submitting drawings, dimensions, identification of products, shop work manufacturing instructions, design calculations, statement of compliance with Contractual standards, notation of dimensions established by field measurement, relationship to adjoining construction clearly indicated, seal and signature of a professional engineer if specified, and any other information required by individual Contract provisions.”

Replace the first sentence of the first paragraph of subsection 5 with the following:

“Product data consist of printed information such as manufacturer’s product specifications, manufacturer’s installation instructions, manufacturer’s catalog cuts, standard color charts, wiring diagrams showing factory-installed wiring, printed performance curves, operational range diagrams, and mill reports.”

Replace the first sentence of the first paragraph of subsection 7 with the following:

“Quality assurance submittals consist of qualification data, design data, certifications, manufacturer’s instructions, manufacturer’s field reports, test reports, Material Safety Data Sheets (MSDSs), and other quality assurance information required by individual Contract provisions.”

1.20-1.05.04—Coordination of Special Provisions, Plans, Supplemental Specifications and Standard Specifications and Other Contract Requirements:

Delete the first and second paragraphs and replace with the following:

“Industry Standards: Each entity engaged in construction of the Contract shall be familiar with industry standards applicable to that entity’s construction activities. If printed standards have been established by organizations referenced in Article 1.01.02 or in the Contract, the Contractor shall obtain copies of said standards directly from the publication source.

Unless the Special Provisions include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Special Provisions to the extent referenced. Such standards are made a part of the Contract by reference.”

Add the following article:

1.20-1.05.08—Schedules and Reports:

Daily Construction Reports: The Contractor shall assist the Engineer in the preparation of a daily construction report, by ensuring that each of the Contractor’s

employees and subcontractors working on the Project site on a given day signs the Engineer's sign-in sheet for that day; and by keeping and providing to the Engineer its own daily list of employees and subcontractors who worked on the Project site on that day.

Add the following article:

1.20-1.05.23—Requests for Information (RFIs):

The Contractor shall forward all RFIs to the Engineer in writing (facsimile or other electronic document) for review. The Engineer will forward the RFI to the Designer for review. Upon receipt of an RFI, the Designer will attempt to determine if additional information is required from the Contractor to respond to the RFI, and request said information from the Engineer.

All other RFIs will be responded to within 10 calendar days of receipt by the Designer.

1.20-1.05.24—Project Meetings:

Delete the third paragraph under subsection 1.

Delete the second paragraph under subsection 2 and replace with the following:

"The meeting participants shall review progress of other construction activities and preparations for the particular activity under consideration, including requirements of Contract documents, related requests for interpretations, related construction orders, purchases, deliveries, submittals, review of mockups, possible conflicts, compatibility problems, time schedules, weather limitations, manufacturer's written recommendations, warranty requirements, compatibility of materials, acceptability of substrates, temporary facilities and controls, space and access limitations, regulations of authorities having jurisdiction, testing and inspecting requirements, installation procedures coordination with other work, required performance results, protection of adjacent work, and protection of construction and personnel."

Delete the second, third and fourth paragraph under subsection 3 and replace with the following:

"The Contractor shall provide the Engineer with a detailed agenda for the proposed meeting, specifying what topics will be covered. In addition to representatives of the Engineer, each subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall attend these meetings. All participants at the meeting shall be familiar with the Project and authorized to conclude matters relating to the Project.

At each progress meeting, the participants shall (1) review items of significance that could affect progress; (2) discuss topics appropriate to the current status of the Project;

(3) review progress since the last meeting; (4) determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to the Contractor's Construction Schedule; (5) determine how to expedite any Project work that may be behind schedule; (6) discuss whether or not schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract time; and (7) review the present and future needs of each entity represented at the meeting, including such items as interface requirements, time, sequences, deliveries, off-site fabrication problems, access, site utilization, temporary facilities and controls, hours of work, hazards and risks, housekeeping, quality and work standards, status of correction of deficient items, field observations, requests for interpretations, status of proposal requests, pending changes, status of construction orders, and documentation of information for payment requests. The Engineer will distribute copies of minutes of the meeting to the Designer and the Contractor. The Contractor shall distribute copies to parties who were or should have been at the meeting."

Delete article 1.20-1.05.25—Schedules and Reports in its entirety

1.20-1.06.08—Warranties:

Delete the eighth and ninth paragraph and replace with the following:

"The Contractor shall:

(a) Bind warranties in heavy-duty, commercial-quality, durable 3-ring vinyl-covered loose-leaf binders, thick enough to accommodate the contents, and sized to receive 8 1/2-inch x 11-inch paper (216-millimeter x 279-millimeter) paper.

(b) Identify the binder's contents on the binder's front and spine with the typed or printed title "WARRANTIES," the Project title or name, and the name of the Contractor.

(c) Provide a heavy paper divider with a tab for each separate warranty.

(d) Mark the tab to identify the related product or installation.

(e) Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the Contractor or pertinent subcontractor.

(f) Furnish to the Department a written warranty for all Project work accompanied by a cover letter with the following contents:

[Addressed to:]

Commissioner of Transportation
Department of Transportation
P.O. Box 317546
Newington, Connecticut 06131-7546

Project Title and Number

[We] hereby warrant all materials and workmanship for all work performed under this Contract for a period of one (1) year from [date of issuance of C.O.C.] against failures of

workmanship and materials in accordance with the Contract. Furthermore, as a condition of this warranty, [we] agree to have in place all insurance coverage identified in the Contract for the performance of any warranty work.

[Signature:] [Name of authorized signatory]
[Title]

(g) Submit to the Engineer, upon completion of installation of materials or assemblies that are required to have either a flame-rating or a fire-endurance hourly rating, a detailed letter certifying that the required rating has been attained.

Upon determination by the Engineer that Project work covered by a warranty has failed, the Contractor shall replace or rebuild the work to an acceptable condition complying with Contract requirements. The Contractor is responsible for the cost of replacing or rebuilding defective construction or components and those which may have needed to be damaged or removed in order to cure the defective work including costs of material, equipment, labor, and material disposal, regardless of whether or not the State has benefited from use of the work through a portion of its anticipated useful service life. The Contractor shall respond to the Project Site when Project work covered by a warranty has failed within 3 calendar days, unless in the Engineer's opinion said failure is deemed to be an emergency, in which case the Contractor shall respond to the Project Site as directed by the Engineer."

1.20-1.08.03—Prosecution of Work:

Under subsection '3. Cutting and Patching,' delete the heading 'B. Protection of Structural Elements' and replace with the following:

"B. Protection:"

Move the existing first and second paragraphs to under the following subparagraph:

"1. Structural Elements:"

Add the following after the first paragraph under B:

"2. Operational Elements: The Contractor shall not cut and patch operating elements and related components in a manner that results in their reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

3. Miscellaneous Elements: The Contractor shall not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety."

Add the following after subsection 3:

“4. Selective Demolition:

A. Definitions:

Remove: The Contractor shall detach materials from existing construction and legally dispose or recycle them off-site, unless indicated to be removed and salvaged or removed and reinstalled. Except for materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Engineer's property, demolished materials shall become Contractor's property and shall be removed from the Project Site.

Remove and Salvage: The Contractor shall detach materials from existing construction and deliver them to Engineer. The Engineer reserves the right to identify other materials for salvage during the course of demolition.

Remove and Reinstall: The Contractor shall detach materials from existing construction, prepare them for reuse, and reinstall them where indicated.

Existing to Remain: Existing materials of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. Approval Process:

The Contractor shall submit pre-demolition photographs to the Engineer prior to the commencement of Project work to show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations.

Well in advance of performing any selective demolition on the Project, the Contractor shall submit to the Engineer a proposal describing the procedures that the Contractor intends to use for same.

The Contractor shall include the following information, as applicable, in its proposal: (1) detailed sequence of selective demolition and removal work with starting and ending dates for each activity while ensuring that the Engineer's on-site operations are not disrupted; (2) interruption of utility services; (3) coordination for shutoff, capping, and continuation of utility services; (4) use of elevators and stairs; (5) locations of temporary partitions and means of egress; (6) coordination of Engineer's continuing occupancy of portions of existing building and of Engineer's partial occupancy of completed Project work; and (7) means of protection for items to remain and items in path of waste removal from building.

The Contractor shall comply with (1) governing EPA notification regulations before beginning selective demolition; (2) hauling and disposal regulations of authorities having jurisdiction; (3) ANSI A10.6; and (4) NFPA 241.

The Engineer will conduct a Pre-Demolition Meeting at the Project site in accordance with Article 1.20-1.05.24. Said meeting will review the methods and procedures related to selective demolition including, but not limited to, the following: (1) an inspection and discussion of the condition of construction to be selectively demolished; (2) a review of the structural load limitations of the existing structure; (3) a review and finalization of the selective demolition schedule and a verification of the availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays; (4) a review of requirements of Project work performed by other trades that rely on substrates exposed by selective demolition operations; and (5) a review of areas where existing construction is to remain and requires protection.

C. Repair Materials:

The Contractor shall comply with Article 1.20-1.08.03 subsection 3E for repair materials and shall comply with material and installation requirements specified in other Contract provisions.

D. Examination:

The Contractor shall (1) verify that utilities have been disconnected and capped; (2) survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required; (3) inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged; (4) investigate and measure the nature and extent of unanticipated mechanical, electrical, or structural elements that conflict with intended function or design and submit a written report to Engineer; and (5) perform surveys as the Project work progresses to detect hazards resulting from selective demolition activities.

E. Utility Services:

The Contractor shall (1) maintain existing utility services indicated to remain and protect them against damage during selective demolition operations; (2) not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by the Engineer; (3) provide temporary services during interruptions to existing utilities, as acceptable to Engineer; (4) provide at least 3 calendar days' notice to the Engineer if shutdown of service is required during changeover; and (5) locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished. The Contractor shall arrange to shut off indicated utilities with utility companies. If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition the Contractor shall provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.

The Contractor shall cut off pipe or conduit in walls or partitions to be removed and shall cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

The Contractor shall refer to other Contract provisions for shutting off, disconnecting, removing, and sealing or capping utilities. The Contractor shall not start selective demolition work until utility disconnecting and sealing have been completed and verified by the Engineer in writing.

F. Preparation:

The Contractor shall conduct selective demolition and debris-removal operations to ensure minimum interference with adjacent occupied and used facilities on the Project site. The Contractor shall not disrupt the Owner's operations without the Engineer's permission. The Contractor shall protect existing site improvements, appurtenances, and landscaping to remain.

The Contractor shall provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain. The Contractor shall provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas. The Contractor shall protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations. The Contractor shall cover and protect furniture, furnishings, and equipment that have not been removed.

The Contractor shall provide temporary enclosures for protection of existing building and construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. The Contractor shall provide temporary weathertight enclosure for building exterior. Where heating is needed and permanent enclosure is not complete, the Contractor shall provide insulated temporary enclosures and shall coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.

The Contractor shall erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

The Contractor shall provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished. The Contractor shall strengthen or add new supports when required during progress of selective demolition.

G. Pollution Controls:

The Contractor shall comply with governing regulations pertaining to environmental protection.

The Contractor shall not use water when it may create a hazardous or objectionable condition such as ice, flooding, or pollution.

The Contractor shall remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas. The Contractor shall remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

The Contractor shall clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. The Contractor shall return adjacent areas to condition existing before selective demolition operations began.

H. Performance:

The Contractor shall not use explosives for demolition purposes.

The Contractor shall demolish and remove existing construction only to the extent required by new construction and as indicated. The Contractor shall (1) proceed with selective demolition systematically; (2) neatly cut openings and holes plumb, square, and true to dimensions required; (3) use cutting methods least likely to damage remaining or adjoining construction; (4) use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces; (5) temporarily cover openings to remain; (6) cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces; (7) not use cutting torches until work area is cleared of flammable materials; (8) verify condition and contents of concealed spaces such as duct and pipe interiors before starting flame-cutting operations; (9) maintain fire watch and portable fire-suppression devices during flame-cutting operations; (10) maintain adequate ventilation when using cutting torches; (11) remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site; (12) remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation; (13) locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing; and (14) dispose of demolished items and materials promptly.

The Contractor shall comply with the Engineer's requirements for using and protecting walkways, building entries, and other building facilities during selective demolition operations.

The Contractor shall demolish and remove foundations and other below-grade structures completely unless otherwise indicated on the plans. The Contractor shall fill below-grade areas and voids resulting from demolition of structures with granular fill materials. Prior to placement of fill materials, the Contractor shall ensure that the areas

to be filled are free of standing water, frost, frozen material, trash, and debris. After fill placement and compaction, grade surface to meet adjacent contours and provide flow to surface drainage structures. Backfilling and grading related to demolition is included in the Major Lump Sum Item (MLSI) for the Project. There will be no separate payment for this backfilling and grading.

The Contractor shall (1) demolish concrete in sections; (2) cut concrete at junctures with construction to remain to the depth shown on the Contract plans and at regular intervals using power-driven saw; and (3) remove concrete between saw cuts.

The Contractor shall (1) demolish masonry in small sections; (2) cut masonry at junctures with construction to remain using power-driven saw; and (3) remove masonry between saw cuts.

The Contractor shall (1) saw-cut perimeter of concrete slabs-on-grade to be demolished as shown on the Contract plans; and (2) break up and remove concrete slabs-on-grade.

The Contractor shall (1) remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum; and (2) remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.

The Contractor shall (1) only remove existing roofing in one day to the extent that it can be covered by new roofing; and (2) refer to other Contract provisions for new roofing requirements.

The Contractor shall remove air conditioning equipment without releasing refrigerants.

I. Reuse of Building Elements:

The Contractor shall not demolish building elements beyond what is indicated on the plans without the Engineer's approval.

J. Removed and Salvaged Materials:

Unless otherwise directed by the Engineer, the Contractor shall (1) store materials in a secure area until delivery to the owner; (2) transport materials to the owner's storage area off-site; and (3) protect materials from damage during transport and storage.

K. Removed and Reinstalled Materials:

Unless otherwise directed by the Engineer, the Contractor shall (1) clean and repair materials to functional condition adequate for intended reuse; (2) paint equipment to match the color of new equipment; (3) protect materials from damage during transport and storage; and (4) reinstall items in locations indicated complying with installation

requirements for new materials and equipment and providing connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

L. Existing Materials to Remain:

The Contractor shall protect construction indicated to remain against damage and soiling during selective demolition.

The Contractor shall drain piping and cap or plug piping with the same or a compatible piping material for piping to be abandoned in place.

The Contractor shall cap or plug ducts with the same or a compatible ductwork material for ducts to be abandoned in place.

The Contractor shall cut and remove concealed conduits and wiring to be abandoned in place 2-inches (50-mm) below the surface of the adjacent construction, cap the conduit end, and patch the surface to match the existing finish. The Contractor shall cut existing conduits installed in concrete slabs to be abandoned in place flush with the top of the slab and fill conduit end with a minimum of 4-inches (100-mm) of concrete.

M. Patching and Repairing:

The Contractor shall comply with Article 1.20-1.08.03 subsection 3H for patching and repairing damage to adjacent construction caused by selective demolition operations.

N. Disposal of Demolished Materials:

The Contractor shall (1) not allow demolished materials to accumulate or be sold on the Project Site; (2) not burn demolished materials on the Project Site; and (3) promptly and legally dispose or recycle demolished materials off the Project Site."

1.20-1.08.05—Personnel and Equipment:

Replace "FM with "FMG" in subsection (a)

Add the following article:

"1.20-1.08.12—Semi-Final and Final Inspections:

1. Semi-Final Inspection: Before requesting the Semi-Final Inspection, the Contractor shall show 100% completion for all Project work claimed as complete. The Contractor shall submit final test/adjust/balance records including the final air and water balance report. For all incomplete Project work, the Contractor shall prepare its own "Punch List" of the incomplete items and reasons the work is not complete. The Contractor shall submit final test/adjust/balance records including the final air and water balance report.

On receipt of a Contractor request for inspection, the Engineer will proceed with inspection or notify the Contractor of unfulfilled requirements. The Engineer will prepare a "Punch List" of unfilled, substandard, or incomplete items. During this inspection, the Contractor shall have all technicians necessary to demonstrate the complete operation of all systems on-site. Examples of such systems include, but are not limited to, the following: boiler, HVAC, fire alarm, and building automation. The Engineer will advise the Contractor of the construction that must be completed or corrected before the issuance of the C.O.C. Results of the completed inspection will form the basis of requirements for the Final Inspection. The Engineer reserves the right to issue the C.O.C. after the Semi-Final Inspection if there are no Building Code or Fire Code compliance issues or any major "Punch List" items.

2. Final Inspection: Before requesting Final Inspection for issuance of the C.O.C., the Contractor shall: (1) submit specific warranties, maintenance service agreements, final certifications and similar documents; (2) submit Record Drawings, Record Specifications, operations and maintenance manuals, final project photographs, property surveys, and similar final record information; (3) deliver spare parts; (4) make final changeover of permanent locks and deliver the keys to the Engineer; (5) complete start-up testing of systems; (6) train the owner's operation and maintenance personnel; (7) discontinue or change over and remove temporary facilities from the Project Site, along with construction tools, mock-ups, and similar elements; (8) complete final cleaning requirements, including touch-up painting; (9) touch-up and otherwise repair and restore marred exposed finishes to eliminate visual defects; (10) submit a certified copy of the Engineer's "Punch List" of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Engineer; (11) submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Final Inspection, or when the Engineer took possession of and responsibility for corresponding elements of the Project work; and (12) install permanent electrical service. The Contractor shall install permanent electrical service prior to Semi-Final Inspection if requested by the Engineer, or if necessary for the Engineer or Contractor to perform testing of building and other related systems and equipment to certify acceptance and completion of Project work. The Contractor shall submit all outstanding items or unacceptable submissions from the Semi-Final Inspection, or other outstanding items required for submittal, prior to the Final Inspection.

On receipt of a Contractor request for inspection, the Engineer will proceed with inspection and notify the Contractor of unfulfilled requirements."

1.20-1.08.13—Termination of the Contractor's Responsibility:

Add subsection 3 as follows:

"3. Insurance Coverage: The Contractor shall have in place all insurance coverage identified in Article 1.03.07 for the performance of any warranty work."

1.20-1.08.14—Acceptance of Project:

Add the following to subsection 2 under the heading “Equipment and Systems Maintenance Manual:”

“(j) Copies of maintenance agreements with service agent name and telephone number.”

Add the following paragraph in subsection 3 after the second paragraph:

“The Contractor shall provide a syllabus prior to the training to ensure that the appropriate owner’s operation and maintenance personnel are in attendance.”

Delete the last paragraph and replace with the following:

“ The Contractor shall submit to the Engineer for approval, a qualified commercial videographer to videotape the training sessions. The videographer shall be a firm or an individual of established reputation that has been regularly engaged as a professional videographer for not less than 3 years.

The Contractor shall video record each training session and provide said video in DVD format to the Engineer for the owner’s future use.”

Add the following section:

“1.20-1.09.06—Partial Payments:

With each payment request under the MLSI, the Contractor shall submit AIA Form G702 (Application and Certificate of Payment) and Form G703 (Continuation Sheet). The Contractor is not required to obtain the Architect’s signature on Form G702. Once approved by the Engineer, the Forms G702 and G703 become the basis of payment under the MLSI.”

Add the following section:

“1.20-9.75.04—Method of Measurement:

Mobilization as defined in Article 1.20-1.03.01 will be paid in the manner described hereinafter; however, the determination of the total contract price earned shall not include the amount of mobilization earned during the period covered by the current monthly estimate – but shall include amounts previously earned and certified for payment:

1. When the first payment estimate is made, 25 percent of the “Mobilization” line item will be certified for payment.

2. When the Baseline Schedule, as specified under Section 1.05.08, is accepted, 50 percent of the "Mobilization" line item, minus any previous payments, will be certified for payment.

3. When 10 percent of the total original contract price is earned and the Baseline Schedule, as specified under Section 1.05.08, is accepted, 75 percent of the "Mobilization" line item, minus any previous payments, will be certified for payment.

4. When 30 percent of the total original contract price is earned and the Baseline Schedule, as specified under Section 1.05.08, is accepted, 100 percent of the "Mobilization" line item, minus any previous payments, will be certified for payment.

Project Closeout as defined in Article 1.20-1.03.01 shall include demobilization of plant and equipment, completion of all physical work, and administrative closeout items necessary to satisfy all Contract requirements. Project Closeout will be paid in the manner described hereinafter:

1. When the non-administrative project completion requirements (as specified under Article 1.08.13) and the administrative completion requirements (as specified under Article 1.08.14) have been satisfied, 100 percent of the "Project Closeout" line item will be certified for payment."

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 2.02
ROADWAY EXCAVATION, FORMATION OF
EMBANKMENT AND DISPOSAL OF
SURPLUS MATERIAL**

2.02.01 – Description:

In the first sentence, insert “, swales” between “channels” and “and other miscellaneous construction to the ...”

2.02.04 – Method of Measurement:

In the second to last Paragraph, replace the last sentence with the following:
“Bituminous parking areas are considered as bituminous concrete pavement.”

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 2.05
TRENCH EXCAVATION**

2.05.01—Description:

In Paragraph 2, delete the only sentence and replace with the following:

“2) The removal of stormwater drainage structures, stormwater pipes and appurtenances beyond the limits of the roadway and structure excavation.”

In Subarticle 2, Rock in Trench, delete the only sentence and replace with the following:

“(2) Rock, insofar as it applies to trench excavation, shall be defined as rock in definite ledge formation, boulders, or portions of boulders, cement masonry structures, concrete structures, reinforced concrete pipe, Portland cement concrete pavement or base, of 1/2 cubic yard (0.5 cubic meters) or more in volume, removed as indicated or directed from within the payment lines for trench excavation.”

2.05.04—Method of Measurement:

*In the first sentence under **Horizontal Payment Limits** insert “culvert ends,” between “pipe culverts,” and “pipe arches,”*

2.05.05—Basis of Payment:

In Paragraph 13 - Delete the entire sentence “There will be no direct payment for the plugging of existing pipes...” and replace it with the following:

“There will be no direct Payment for the plugging of existing pipes, removal and disposal of metal or plastic pipes or for the breaking up of floors in drainage structures being abandoned. The cost shall be included in the contract unit prices of the drainage and excavation items.”

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 2.12
SUBBASE**

2.12.02 – Materials:

Delete the second sentence: "Grading 'B' shall be used."

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 2.16
PERVIOUS STRUCTURE BACKFILL**

2.16.01 - Description:

Add the following sentence after the only sentence:

“This item shall also consist of furnishing and placing crushed stone or gravel in permeable material bags at the inlet ends of weep holes in structures to the dimensions indicated on the plans or as ordered by the Engineer.”

2.16.02 – Materials:

Add the following paragraph after the only sentence:

- “ The materials for bagged stone shall conform to the following requirements:
1. The crushed stone or gravel shall conform to the grading requirements of Article M.01.01 for No. 3 or No. 4 coarse aggregate or a mixture of both.
 2. The bag shall be of permeable material sized to contain 1 c.f. (0.03 cu.m) of loosely packed granular material.”

2.16.03 - Construction Methods:

Add the following paragraph at the end of the section:

“ Where weep holes are installed, bagged stone shall be placed around the inlet end of each weep hole, to prevent movement of the pervious material into the weep hole. Approximately 1 c.f. (0.03 cu.m) of crushed stone or gravel shall be enclosed in each of the permeable material bags. All bags shall then be securely tied at the neck with cord or wire so that the enclosed material is contained loosely. The filled bags shall be stacked at the weep holes to the dimensions shown on the plans or as directed by the Engineer. The bags shall be unbroken at the time pervious material is placed around them, and bags which are broken or burst prior to or during the placing of the pervious material shall be replaced at the Contractor's expense.”

2.16.04 - Method of Measurement:

Add the following paragraph after the only paragraph:

“ There will be no direct payment for bagged stone, but the cost thereof shall be included in the cost of the work for “Pervious Structure Backfill.””

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 3.04
PROCESSED AGGREGATE BASE**

Delete the entire Section and replace with the following:

“ 3.04.01 - Description: The base shall consist of a foundation constructed on the prepared subbase or subgrade in accordance with these specifications and in conformity with the lines, grades, compacted thickness and typical cross-section as shown on the plans.

3.04.02 - Materials: All materials for this work shall conform to the requirements of Article M.05.01.

3.04.03 - Construction Methods: Only one type of coarse aggregate shall be used on a Project unless otherwise permitted by the Engineer.

Prior to placing the processed aggregate base, the prepared subbase or subgrade shall be maintained true to line and grade, for a minimum distance of 200 ft (60 m) in advance of the work. None of the aggregate courses shall be placed more than 500 ft (150 m) ahead of the compaction and binding operation on that particular course.

The processed aggregate base shall be spread uniformly by a method approved by the Engineer. The thickness of each course shall not be more than 4 inches (100 millimeters) after compaction, unless otherwise ordered.

After the aggregate is spread, it shall be thoroughly compacted and bound by use of equipment specifically manufactured for that purpose. Rollers shall deliver a ground pressure of not less than 300 lbs/in (52.5 N/mm) of contact width and shall have a weight (mass) not less than 10 t (9100 kg). Vibratory units shall have a static weight (mass) of not less than 4 t (3650 kg). Water may be used during the compaction and binding operation and shall be applied from an approved watering device. The compacting and binding operation shall begin at the outside edges, overlapping the shoulders for a distance of not less than 6 in (150 mm) and progress towards the middle, parallel with the centerline of the pavement. The work shall cover the entire surface of the course with uniform overlapping of each preceding track or pass. Areas of super-elevation and special cross slope shall be compacted by beginning at the lowest edge and proceeding towards the higher edge, unless otherwise directed by the Engineer. The compacting and binding operation shall be continued until the voids in the aggregates have been reduced to provide a firm and uniform surface satisfactory to the Engineer. The amount of compactive effort shall in no case shall be less than four (4) complete passes of the compacting and binding operations. All aggregate shall be completely compacted and bound at the end of each day's work or when traffic is to be permitted to operate on the road. The dry density of each layer of processed aggregate base after compaction shall not be less than ninety-five percent (95%) of the dry density

for that material when tested in accordance with AASHTO T180, Method D.

Should the subbase or subgrade material become churned up or mixed with the processed aggregate base at any time, the Contractor shall, without additional compensation remove the mixture. The Contractor shall add new subbase material, if required, and reshape and recompact the subbase in accordance with the requirements of Article 2.12.03. New aggregate material shall be added, compacted and bound, as hereinbefore specified, to match the surrounding surface.

Any surface irregularities which develop during, or after work on each course, shall be corrected by loosening material already in place and removing or adding aggregate as required. The entire area, including the surrounding surface, shall be re-compacted and rebound until it is brought to a firm and uniform surface satisfactory to the Engineer.

3.04.04 - Method of Measurement: Processed Aggregate Base will be measured horizontally in-place after final grading and compaction. Materials placed beyond the horizontal limits indicated on the plans will not be measured for payment.

The total thickness shall be as indicated on the plans, or as ordered by the Engineer and within a tolerance of minus three-fourths of an inch ($-\frac{3}{4}$ ") to plus one-half inch ($+\frac{1}{2}$ ") (-19 mm to +13 mm).

Measurements to determine the thickness will be taken by the Engineer at intervals of 500 ft (150 m) or less, along lanes, and shall be considered representative of the lane. For the purpose of these measurements, a shoulder will be considered a lane.

If a thickness measurement is taken and found deficient, additional measurements considered necessary by the Engineer will be taken to determine the longitudinal limits of the deficiency. Areas not within allowable tolerances shall be corrected, as ordered by the Engineer, without additional compensation to the Contractor.

3.04.05 - Basis of Payment: This work will be paid for at the Contract unit price per cubic yard (cubic meter) for "Processed Aggregate Base," complete in place, which price shall include all materials, tools, equipment and work incidental thereto.

Pay Item	Pay Unit
Processed Aggregate Base	c.y. (cu.m)"

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 4.01
CONCRETE FOR PAVEMENT**

Article 4.01.03—Construction Methods:

Replace Subarticle A. "Composition" with the following:

" A. Material Documentation, Transportation and Testing: All material delivered to the Project shall be documented, transported and testing in accordance with Subarticle 6.01.03-3 Transportation and Delivery of Concrete and Subarticle 6.01.03-4 Acceptance Testing and Test Specimens. The plastic properties for concrete pavement shall conform to the standard mix properties as indicated in Subarticle 6.01.03-4a.

In addition, the air content of the plastic concrete shall be determined in accordance with AASHTO Method T152, Pressure Method. No alternative method is acceptable."

Delete Subarticles B, C, D and E.

Change Subarticle F "Placing Concrete" to be Subarticle B and as follows:

Article 4.01.03-B. Placing Concrete:

3. Placement:

In the last sentence of the first paragraph, change "... tested in accordance with 4.01.03-I ..." to read "... tested in accordance with Subarticle 4.01.03-D ..."

6. Joints:

(e) Load Transfer Devices:

Change the only sentence as follows:

"Load transfer devices shall conform to the requirements of Article M.03.08."

7. Curing:

(a) Liquid Membrane-Forming Cure:

Change the first sentence as follows:

"The liquid curing compound shall conform to Subarticle M.03.04-3."

(b) Moist Curing:

Change the end of the first sentence as follows:

“... moist mats of the size and quality specified in Subarticle M.03.04-2.”

(c) Cover Sheet Curing:

Change the end of the first sentence as follows:

“... paper or polyethylene cover sheets conforming to Subarticle M.03.04-4.”

Change Subarticle G “Protection of Pavement” to be Subarticle C.

Change Subarticle H “Riding Surface Tests” to be Subarticle D.

Change Subarticle I “Flexural Testing of Concrete” to be Subarticle E.

Change Subarticle J “Opening to Traffic” to be Subarticle F.

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 5.08
SHEAR CONNECTORS**

5.08.02 – Materials:

Replace the only paragraph with the following:

“ Stud shear connectors shall conform to the requirements of Subarticle M.06.02-4 Welded Stud Shear Connectors.”

5.08.03 – Construction Methods:

Replace the last sentence of the third paragraph with the following:

“ Stud shear connectors may be stacked to meet heights greater than the 8 in (200 mm) maximum for individual studs.”

Replace the last sentence of the fifth paragraph with the following:

“ Studs exhibiting no signs of failure after bending shall be left in the bent position, if allowed by the Engineer.”

5.08.04 – Method of Measurement:

Delete the entire article and replace with the following:

“ Installed and accepted shear connectors will be measured as units.
For stacked studs, the Department will measure for payment any stack higher than 8 in (200 mm) as two (2) studs.”

5.08.05—Basis of Payment:

Delete the entire article and replace with the following:

“ This work will be paid for at the Contract unit price each for “Shear Connectors,” which price shall include all materials, tools, equipment and labor incidental thereto for all work under this item on the Project.

Pay Item	Pay Unit
Shear Connectors	ea. (ea.)”

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 5.14
PRESTRESSED CONCRETE MEMBERS**

5.14.03 – Construction Methods:

2. Prestressing:

Change the outline level of “Final Stressing of Straight Strands:” and “Final Stressing of Draped Strands:” and their subsections as follows:

- “ **A. Final Stressing of Straight Strands:**
 (1) Single-strand tensioning:
 (2) Multiple-strand tensioning:
B. Final Stressing of Draped Strands:
 (1) Partial stressing and subsequent strains:
 (2) Final stressing in draped position:”

5. Finishing: Deck Units:

Change the first sentence as follows:

“Deck units in structures that will have a bituminous concrete wearing surface shall be given a float finish on the top surface as specified in Subarticle 6.01.03-10.”

9. Joining Deck Units:

Change the end of the last sentence of the first paragraph as follows:

“... shall be filled with non-shrink grout conforming to the requirements of Article M.03.05.”

12. Inspection:

Change the beginning of the first sentence as follows:

“The provisions of Subarticle 6.03.03-3 (Shop Fabrication), (a) Notification shall apply to the steel items, ...”

16: Methods and Equipment:

Change the last sentence as follows:

“The results of this investigation, including computations, shall be submitted to the Engineer.”

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 6.01
CONCRETE FOR STRUCTURES**

Delete the entire Section and replace it with the following:

**SECTION 6.01
CONCRETE FOR STRUCTURES**

- 6.01.01—Description**
- 6.01.02—Materials**
- 6.01.03—Construction Methods**
- 6.01.04—Method of Measurement**
- 6.01.05—Basis of Payment**

6.01.01—Description: This item shall include concrete for use in bridges and culverts, walls, catch basins, drop inlets and other incidental construction as required. The concrete shall be composed of Portland cement, pozzolans, fine and coarse aggregate, admixtures and water, prepared and constructed in accordance with these specifications, at the locations and of the form dimensions and class shown on the plans, or as directed by the Engineer.

The use of concrete from dry batch or central mixed plants is permitted for all concrete mixtures.

6.01.02—Materials: The materials for this work shall conform to the requirements of Section M.03.

6.01.03—Construction Methods:

1. Falsework and Forms: Falsework is considered to be any temporary structure which supports structural elements of concrete, steel, masonry or other material during the construction or erection. Forms are considered to be the enclosures or panels which contain the fluid concrete and withstand the forces due to its placement and consolidation. Forms may in turn be supported on falsework.

This work shall consist of the construction and removal of falsework and forms that are designed by the Contractor in the execution of the work, and whose failure to perform properly could adversely affect the character of the Contract work or endanger the safety of adjacent facilities, property, or the public. Falsework and forms shall be mortar tight and of sufficient rigidity and strength to safely support all loads imposed and to produce in the finished structure the lines and grades indicated in the Contract documents. Forms shall also impart the required surface texture and rustication and shall not detract from the uniformity of color of the formed surfaces. Forms shall be of wood, steel or other material approved by the Engineer.

- (a) **Design:** The design of falsework and formwork shall conform to the *AASHTO Guide Design Specifications for Bridge Temporary Works*, or to other established and generally accepted design codes such as ACI Standard *ACI 347 Recommended Practice for Concrete Formwork* or specific form or falsework manufacturer specifications. When other than new or undamaged materials are used, appropriate reductions in allowable stresses, and decreases in resistance factors or imposed loads shall be used for design.
- (b) **Loads:** The design of the falsework and forms shall be based on load factors specified in the *AASHTO LRFD Bridge Design Specifications* and all applicable load combinations shall be investigated. The design load for falsework shall consist of the sum of appropriate dead and live vertical loads and any horizontal loads.

As a minimum, dead loads shall include the weight (mass) of the falsework and all construction material to be supported. The combined unit weight (density) of concrete, reinforcing and pre-stressing steel and forms that is supported shall be assumed to be not less than:

1. Normal-weight (normal-density) concrete: 0.16 kip/ft³ (2560 kg/m³)
2. Lightweight (low-density) concrete: 0.13 kip/ft³ (2080 kg/m³)

Live loads shall consist of the actual weight (mass) of any equipment to be supported, applied as concentrated loads at the points of contact and a uniform load of not less than 0.02 kip/ft² (0.001 MPa) applied over the area supported, plus 0.075 kip/ft (1.10 N/mm) applied at the outside edge of deck overhangs.

The horizontal load used for the design of the falsework bracing system shall be the sum of the horizontal loads due to equipment; construction sequence including unbalanced hydrostatic forces from fluid concrete and traffic control devices; stream flow, when applicable; and an allowance for wind. However, in no case shall the horizontal load to be resisted in any direction be less than two percent (2%) of the total dead load.

For post-tensioned structures, the falsework shall also be designed to support any increase in or redistribution of loads caused by tensioning of the structure. Loads imposed by falsework onto existing, new, or partially completed structures shall not exceed those permitted in 6.01.03-12, "Application of Loads."

- (c) **Working Drawings:** The working drawings for falsework and formwork shall be prepared in accordance with Article 1.05.02 whenever the falsework or formwork exceeds 14.0 feet (4300 mm) in height or whenever vehicular, marine, or pedestrian traffic may travel under or adjacent to the falsework or formwork. Working drawings shall include the sequence, method and rate of placement of the concrete.

Manufacturer catalog cuts or written installation procedures shall be provided for any clips, braces, hangers or other manufactured parts used with the formwork or falsework.

- (d) Construction:** Forms and falsework shall be built true to lines and grades, shall be strong, stable, firm, mortar-tight and adequately braced or tied, or both. They shall be designed and constructed to withstand all loads and pressures including those imposed by plastic concrete, taking full account of the stresses due to the rate of placement, effect of vibration and conditions brought about by construction methods. Forms and falsework shall be constructed to compensate for variations in camber of supporting members and allow for deflections.

Falsework and formwork shall be chamfered at all sharp corners, unless otherwise ordered or permitted, and shall be given a slight bevel or draft in the case of projections to ensure satisfactory removal. Materials for falsework and formwork and their supports, ties and bracing, shall be of the type, quality and strength to achieve the structural requirements. Form material in contact with concrete shall provide the finished concrete surface smoothness as specified in 6.01.03-10, "Finishing Concrete Surfaces," and have a uniform appearance.

Falsework and formwork shall be treated with form oil or other release agent approved by the Engineer before the reinforcing steel is placed, or self-releasing forms approved by the Engineer may be used. Release agents which will adhere to or discolor the concrete shall not be used.

Falsework and formwork for concrete surfaces exposed to view shall produce a smooth surface of uniform texture, free of voids, indentations, protrusions and bulges. Panels lining falsework and formwork shall be arranged so that the joint lines form a symmetrical pattern conforming to the general lines of the structure. The same type of form-lining material shall be used throughout each element of a structure. Falsework and formwork shall be sufficiently rigid so that the undulation of the concrete surface shall not exceed 1/4 inch (6 mm) when checked with a 4 foot (1200 mm) straightedge or template.

For non-exposed surfaces the falsework and formwork shall be sufficiently rigid so that the undulation of the concrete surface shall not exceed 1/2 inch (13 mm) when checked with a 4 foot (1200 mm) straightedge or template.

Metal ties and anchors to hold the falsework and formwork in alignment and location shall be so constructed that the metal work can be removed to a depth of at least 2 inches (50 mm) from the concrete surface without damage to the concrete. All cavities resulting from the removal of metal ties shall be filled after removal of forms with cement mortar of the same proportions used in the body of the work or other materials approved by the Engineer, and the surface finished smooth and even, and if exposed in the finished work, shall conform to the texture and color of adjacent surfaces. With permission of the Engineer, the Contractor need not remove from the underneath side of bridge decks portions of metal devices used to support reinforcing steel providing such devices are of material, or are adequately coated with material, that will not rust or corrode. When coated reinforcing steel is required, all metal ties, anchorages, or spreaders that remain in the concrete shall be of corrosion-resistant material or coated with a dielectric material.

Forms shall be clean and clear of all debris. For narrow walls and columns where the bottom of the form is inaccessible, an access opening will be allowed in the form and falsework for cleaning out extraneous material.

- (e) **Date of Completion:** The year in which the superstructure is completed in its entirety shall be cast in at least two (2) places as shown on the plans unless otherwise ordered by the Engineer. The date shall be placed in diagonally opposite ends of the bridge parapets or as designated by the Engineer. The reverse molds for the date shall be furnished by the Contractor.
- (f) **Bridge Decks:** After erection of beams and prior to placing falsework and forms, the Contractor shall take elevations along the top of the beam at the points shown on the plans or as directed by the Engineer. The Contractor shall calculate the haunch depths and provide them to the Engineer a minimum of seven (7) days prior to installing the falsework and forms. The Contractor shall also provide calculations for the setting of the overhang brackets based on the final beam deflection. These calculations shall be based on the final proposed deck grade and parapet elevations.

Falsework or formwork for deck forms on girder bridges shall be supported directly on the girders so that there will be no appreciable differential settlement during placing of the concrete. Girders shall be either braced and tied to resist any forces that would cause rotation or torsion in the girders caused by the placing of concrete for diaphragms or decks, or shown to be adequate for those effects. Unless specifically permitted, welding of falsework support brackets or braces to structural steel members or reinforcing steel shall not be allowed.

- (g) **Stay-In-Place Metal Forms for Bridge Decks:** These forms may be used if shown in the Contract or approved by the Engineer. Prior to the use of such forms and before fabricating any material, the Contractor shall submit working drawings to the Engineer for review in accordance with Article 1.05.02, Working Drawings. These drawings shall include the proposed method of form construction, erection plans including placement plans, attachment details, weld procedure(s), material lists, material designation, gage of all materials, and the details of corrugation. Also, copies of the form design computations shall be submitted with the working drawings. Any changes necessary to accommodate stay-in-place forms, if approved, shall be at no cost to the Department.

The metal forms shall be designed on the basis of the dead load of the form, reinforcement and the plastic concrete, including the additional weight (mass) of concrete [considered to be equivalent to the weight (mass) imposed by an additional concrete thickness equal to three percent (3%) of the proposed deck thickness, but not to exceed 0.3 inches (8 mm)] due to the deflection of the metal forms, plus 50 pounds per square foot (2.40 kilopascals) for construction loads. The allowable stress in the corrugated form and the accessories shall not be greater than 0.725 times the yield strength of the furnished material and the allowable stress shall not exceed 36,000 psi (250 megapascals). The span for design and deflection shall be the clear distance between edges of the beams or girders less 2 inches (50 mm) and shall be measured parallel to the form flutes. The maximum deflection under the weight (mass) of plastic concrete, reinforcement, and forms shall not exceed 1/180 of the form span or 0.5 inches (13 mm), whichever is less. In no case shall the loading

used to estimate this deflection be less than 120 pounds per square foot (586 kilograms per square meter). The permissible form camber shall be based on the actual dead load condition. Camber shall not be used to compensate for deflection in excess of the foregoing limits. The form support angles shall be designed as a cantilever with horizontal leg not more than 3 inches (75 mm).

No stay-in-place metal forms shall be placed over or be directly supported by the top flanges of beams or girders. The form supporting steel angles may be supported by or attached to the top flanges.

Stay-in-place metal forms shall not be used in bays where longitudinal slab construction joints are located, under cantilevered slabs such as the overhang outside of fascia members, and bridges over a salt-laden body of water with a clearance of less than 15 feet (4.5 m) above mean high water level.

Welding to the top flanges of steel beams and girders is not permitted in the areas where the top flanges are in tension, or as indicated on the plans. Alternate installation procedures shall be submitted addressing this condition.

Drilling of holes in pre-stressed concrete beams or the use of power-actuated tools on the pre-stressed concrete beams for fastening of the form supports to the pre-stressed concrete beams will not be permitted. Welding of the reinforcing steel to the pre-stressed units is not permitted.

All edges of openings cut for drains, pipes, and similar appurtenances shall be independently supported around the entire periphery of the opening.

All fabricated stay-in-place metal forms shall be unloaded, stored at the Project site at least 4 inches (100 mm) above the ground on platforms, skids or other suitable supports and shall be protected against corrosion and damage and handled in such a manner as to preclude damage to the forms. Damaged material shall be replaced at no additional cost to the State.

Any exposed form or form support metal where the galvanized coating has been damaged, shall be thoroughly cleaned, wire brushed, then coated with two (2) coats of Zinc Dust – Zinc Oxide primer, FS No. TT-P-641d, Type II or another product acceptable to the Engineer.

The forms shall be installed from the topside in accordance with the manufacturer's recommended installation procedures. The form supports shall ensure that the forms retain their correct dimensions and positions during use at all times. Form supports shall provide vertical adjustment to maintain design slab thickness at the crest of corrugation, to compensate for variations in camber of beams and girders and to allow for deflections. Stay-in-place metal forms shall have a minimum depth of the form valley equal to 2 inches (50 mm). The forms shall have closed tapered ends. Lightweight filler material shall be used in the form valleys.

All field cutting shall be done with a steel cutting saw or shears including the cutting of supports, closures and cutouts. Flame cutting of forms is not permitted.

All welding shall be performed by Department certified welders in accordance with the "Welding" Subarticle in Section 6.03. Welding of forms to supports is not permitted.

The steel form supports shall be placed in direct contact with the flange of stringer or floor beam flanges and attached by bolts, clips, welding where permitted, or other approved means. Form sheets shall not be permitted to rest directly on the top of the stringer or floor beam flanges. The forms shall be securely fastened to form supports with self-drilling fasteners and shall have a minimum bearing length of 1 inch (25 mm) at each end. In the areas where the form sheets lap, the form sheets shall be securely fastened to one another by fasteners at a maximum spacing of 18 inches (450 mm). The ends of the form sheets shall be securely attached to the support angles with fasteners at a maximum spacing of 18 inches (450 mm), or two (2) corrugation widths, whichever is less.

The depth of the concrete slab shall be as shown on the plans and the corrugated forms shall be placed so that the top of the corrugation will coincide with the bottom of the deck slab. No part of the forms or their supports shall protrude into the slab. All reinforcement in the bottom reinforcement mat shall have a minimum concrete cover of 1 inch (25 mm) unless noted otherwise on the plans.

The completed stay-in-place metal form system shall be sufficiently tight to prevent leakage of mortar. Where forms or their installation are unsatisfactory in the opinion of the Engineer, either before or during placement of the concrete, the Contractor shall correct the defects before proceeding with the work.

- (h) Construction Joints:** Construction joints other than those shown on the plans will not be permitted without prior approval of the Engineer. In joining fresh concrete to concrete that has already set, the work already in place shall have all loose and foreign material removed, and the surface roughened and thoroughly drenched with water.

All reinforcing steel shall extend continuously through joints. Where unplanned construction joints may be needed, they shall be constructed as directed by the Engineer.

- (i) Expansion and Contraction Joints:** Expansion and contraction joints shall be constructed at the locations and in accordance with the details specified in the Contract documents. The forming of joint openings shall be dimensioned in accordance with the joint manufacturer's design requirements. Joints include open joints, filled joints, joints sealed with sealants, joints reinforced with steel armor plates or shapes, paraffin coated joints, and joints with combinations of these features.

For mechanical joint systems, the concrete shall be placed in such a manner that does not interfere with the movement of the joint.

Open joints shall be placed at locations designated on the plans and shall be formed by the insertion and subsequent removal of templates of wood, metal or other suitable material. The templates shall be so constructed that their removal may be readily accomplished without damage to the work.

Filled joints shall be made with joint filler, the materials for which shall conform to the requirements of the plans and of these specifications.

- (j) **Pipes, Conduits and Utility Installations:** The Contractor shall coordinate the installation of pipes, conduits and utilities as shown on the plans and in conformance with the Contract documents or as directed by the Engineer. The openings accommodating such pipe, conduit and utility installations shall be incorporated into the formwork by the Contractor.
- (k) **Anchorage:** Anchor bolts and systems shall be set to the requirements of the plans and Contract documents. Anchor bolts and systems shall be clean and free of dirt, moisture or other foreign materials at the time of installation. The anchor bolts and systems shall be installed prior to placing concrete.

With the Engineer's approval, the Contractor may install anchorages after placement and setting of the concrete or in formed holes. The anchorages shall be installed into drilled or formed holes having a diameter and a depth suitable to receive the bolts in accordance with the grout manufacturer's requirements. Such holes shall be located to avoid damage to the existing reinforcement. All holes shall be perpendicular to the plane surface. The Contractor shall take every precaution necessary to prevent damage to the concrete due to freezing of water or grout in anchor bolt holes.

- (l) **Ornament or Reverse Moulds:** Ornamental work, when so noted on the plans, shall be formed by the use of reverse moulds. These moulds shall be produced by a qualified manufacturer approved by the Engineer. They shall be built in accordance with the general dimensions and appearance shown on the plans. The Contractor shall submit all detailed drawings, models, or carvings for review by the Engineer before the moulds are made.

The Contractor shall be responsible for their condition at all times, and shall be required to remove and replace any damaged or defective moulds at no additional cost to the State.

The surfaces of the moulds shall be given a coating of form release agent to prevent the adherence of concrete. Any material which will adhere to or discolor the concrete shall not be used.

Form Liners, if required, shall be installed per the Contract Special Provisions.

- (m) **Removal of Falsework and Forms:** The Contractor shall consider the location and character of the structure, the weather, the materials used in the mix, and other conditions influencing the early strength of the concrete when removing forms and falsework. Methods of removal likely to cause damage to the concrete surface shall not be used.

Supports shall be removed in such a manner as to permit the structure to uniformly and gradually take the stresses due to its own weight. For structures of two (2) or more spans, the sequence of falsework release shall be as specified in the Contract documents or as approved by the Engineer.

Removal shall be controlled by field-cured cylinder tests. The removal shall not begin until the concrete has achieved seventy-five percent (75%) of the design compressive strength. To facilitate finishing, side forms carrying no load may be removed after twenty-four (24) hours with the permission of the Engineer, but the curing process must be continued for seven (7) days.

When the results of field-cured cylinder tests are unavailable, the following periods, exclusive of days when the temperature drops below 40°F (5°C), may govern the removal of forms:

Form Removal Requirements	
Structure Element	Minimum Time Period
Arch Centers, centering under beams, pier caps, and unsupported elements	14 days
Slabs on grade, Abutments and Walls	24 hours
Columns	2 days
Bridge Decks	28 days

The Contractor may submit alternate methods to determine the in-place strength of the concrete for removal of forms and falsework, for review and approval by the Engineer.

2. Protection from Environmental Conditions: The concrete shall be protected from damage due to weather or other environmental conditions during placing and curing periods. In-place concrete that has been damaged by weather conditions shall be either repaired to an acceptable condition or removed and replaced as determined by the Engineer.

(a) Rain Protection: The placement of concrete shall not commence or continue unless adequate protection satisfactory to the Engineer is provided by the Contractor.

(b) Hot Weather Protection: When the ambient air temperature is above 90°F (32°C), the forms, which will come in contact with the mix shall be cooled to below 90°F (32°C) for a minimum of one (1) hour prior to and one (1) hour after completion of the concrete placement by means of a water spray or other methods satisfactory to the Engineer.

(c) Cold Weather Protection: When there is a probability of ambient air temperature below 40°F (5°C) during placement and curing, a Cold-Weather Concreting Plan shall be submitted to the Engineer for review and comment. The Plan shall detail the methods and equipment, including temperature measuring devices, that will be used to ensure that the required concrete and air temperatures are maintained.

1. Placement: The forms, reinforcing steel, steel beam flanges, and other surfaces which will come in contact with the mix shall be heated to a minimum of 40°F (5°C), by methods satisfactory to the Engineer, for a minimum of one (1) hour prior to, and maintained throughout, concrete placement.

2. Curing: For the first six (6) days, considered the initial cure period, the concrete shall be maintained at a temperature of not less than 45°F (7°C) and the air temperature surrounding the structure shall be maintained at a temperature of not less than 60°F (16°C). When the concrete mix includes pozzolans or slag, the initial cure period shall be increased to ten (10) days. After the initial cure period, the air surrounding the structure shall be maintained above 40° F (5°C) for an additional eight (8) days. If external heating is employed, the heat shall be applied and withdrawn gradually and uniformly so that no part of the concrete surface is heated to more than 90°F (32°C) or caused to change temperature by more than 20°F (11°C) in eight (8) hours. The Engineer may reduce or increase the amount of time that the structure must be protected or heated based on an indication of in-place concrete strength acceptable to the Engineer.

(d) Additional Requirements for Bridge Decks: Prior to the application of curing materials, all the concrete placed on bridge decks shall be protected from damage due to rapid evaporation by methods acceptable to the Engineer. During periods of low humidity (less than 60% relative humidity), sustained winds of 25 mph (40 kph) or more, or ambient air temperatures greater than 80°F (25°C) the Contractor shall provide written details of additional measures to be taken during placement and curing.

Protection may include increasing the humidity of the surrounding air with fog sprayers and employing wind-breaks or sun-shades. Additional actions may include reduction of the temperature of the concrete prior to placement, scheduling placement during cooler times of days or nights, or a combination of these actions.

(e) Concrete Exposed to Salt Water: No Construction joints shall be formed between the levels of extreme low water and extreme high water or the upper limit of wave action as determined by the Engineer.

3. Transportation and Delivery of Concrete: All material delivered to the Project shall be supplied by a producer qualified in accordance with Section M.03. The producer shall have sufficient plant capacity and trucks to ensure continuous delivery at the rate required to prevent the formation of cold joints.

(a) Material Documentation: All vendors producing concrete must have their weigh scales and mixing plant automated to provide a detailed ticket. Delivery tickets must include the following information:

1. State of Connecticut printed on ticket
2. Name of producer, identification of plant
3. Date and time of day
4. Type of material
5. Cubic yards (cubic meters) of material loaded into truck
6. Project number, purchase order number, name of Contractor (if Contractor other than producer)
7. Truck number for specific identification of truck
8. Individual aggregate, cement, water weights (masses) and any admixtures shall be printed on plant tickets
9. Water/cement ratio, and
10. Additional water allowance in gallons (liters) based on water/cement ratio for mix

A State inspector may be present to monitor batching and weighing operations.

The Contractor shall notify the Engineer immediately if, during the production day, there is a malfunction of the recording system in the automated plant or weigh scales.

Manually written tickets containing all required information may be allowed for up to one (1) hour after malfunction provided they are signed by an authorized representative of the producer.

- (b) Transportation of Mixture:** Trucks delivering concrete shall be qualified in accordance with Section M.03.

If the concrete mix arrives at the Project with a slump lower than allowed by specification, water may be considered as a means to temper concrete to bring the slump back to within specification. This tempering may only be done prior to discharge with the permission of the Engineer. The quantity of water in gallons (liters) added to the concrete cannot exceed the allowance shown on the delivery ticket.

The concrete shall be completely discharged into the forms within one and one-half (1-1/2) hours from the batch time stamped on the delivery ticket. This time may be extended if the measured temperature of the concrete is below 90°F (32°C). This time may also be reduced if the temperature of the concrete is over 90°F (32°C).

Rejected concrete shall be disposed of by the Contractor at no cost to the State.

The addition of chemical admixtures or air entrainment admixtures at the Project site, to increase the workability or to alter the time of set, will only be permitted if prior approval has been granted by the Engineer. The addition of air entrainment admixtures at the Project site will only be permitted by the producer's quality control staff. The Contractor is responsible for follow-up quality control testing to verify compliance with the Specifications.

4. Acceptance Testing and Test Specimens: The Contractor shall furnish the facilities and concrete required for sampling, transport to the testing location in the field, performing field testing and for casting sample cylinders for compressive-strength determinations. The Department will furnish personnel for sampling and casting Acceptance specimens and the number of specimens required will be determined by the Engineer. The equipment for the Department's testing is provided for elsewhere in the Contract.

- (a) Temperature, Air Content and Slump:** Field testing in accordance with AASHTO T-23, "Making and Curing Concrete Test Specimens in the Field" will be performed at the point of placement and at a frequency determined by the Engineer.

English Units

Standard Mix Class	Air Content	Slump	Concrete Temperature
A (3300 psi)	6.0 +/- 1.5%	4" +/- 1"	60°-90°F
C (3300 psi)			
F (4400 psi)			
Modified Standards ¹	6.0 +/- 1.5% ²	4" +/- 1" ²	
Special Provision Mix ³	As specified	As specified	
¹ Modifications to Standard Mixes, including mixes placed by pumping, shall be reviewed by the Engineer prior to use. These include but are not limited to the use of chemical admixtures such as high range water reducing (HRWR) admixtures and the use of coarse aggregate sizes for that class not specified in M.03.			
² If the <u>only</u> modification is the addition of HRWR, the maximum allowable slump shall be 7 inches.			
³ All concrete mixes with a mix design strength not shown in the table must be approved by the Engineer on a case-by-case basis. Limits on the plastic properties and strength requirements of these mixes are listed in the Specifications.			

Metric Units

Standard Mix Class	Air Content	Slump	Concrete Temperature
A (23MPa)	6.0 +/- 1.5%	100 mm +/- 25mm	15.5 ^o -32 ^o C
C (23 MPa)			
F (30 MPa)			
Modified Standards ¹	6.0 +/- 1.5% ²	100mm +/- 25mm ²	
Special Provision Mix ³	As specified	As specified	
¹ Modifications to Standard Mixes, including mixes placed by pumping, shall be reviewed by the Engineer prior to use. These include but are not limited to the use of chemical admixtures such as high range water reducing (HRWR) admixtures and the use of coarse aggregate sizes for that class not specified in M.03.			
² If the <u>only</u> modification is the addition of HRWR, the maximum allowable slump shall be 175 mm.			
³ All concrete mixes with a mix design strength not shown in the table must be approved by the Engineer on a case-by-case basis. Limits on the plastic properties and strength requirements of these mixes are listed in the Specifications.			

- (b) Acceptance Testing and Compressive Strength Specimens:** Concrete samples are to be taken at the point of placement into the forms or molds. Representatives of the Engineer will sample the mix.

The Contractor shall provide and maintain facilities on the Project site, acceptable to the Engineer, for sampling, transporting the initial sample, casting, safe storage and initial curing of the concrete test specimens as required by AASHTO T-23. This shall include but not be limited to a sampling receptacle, a means of transport of the initial concrete sample from the location of the concrete placement to the testing location, a level and

protected area of adequate size to perform testing, and a specimen storage container capable of maintaining the temperature and moisture requirements for initial curing of Acceptance specimens. The distance from the location of concrete placement to the location of testing and initial curing shall be 100 feet (30 m) or less, unless otherwise approved by the Engineer.

The specimen storage container described in this section is in addition to the concrete cylinder curing box provided for elsewhere in the Contract documents.

After initial curing, the test specimens will be transported by Department personnel and stored in the concrete cylinder curing box until they can be transported to the Division of Materials Testing for strength evaluation.

- (c) Sampling Procedure for Pumping:** It is the responsibility of the Contractor to provide concrete that meets required specifications at the point of placement.

Samples of concrete shall be taken at the discharge end of the pump at the point of placement with the exception of underwater concrete. The Contractor may submit an alternate location to provide a sample from the discharge end of the pump with verification showing that the characteristics of the mix will not be altered from that which would have been attained at the point of placement. The Engineer will review the documentation and other extenuating circumstances when evaluating the request.

In the case of underwater concrete the Contractor shall submit the proposed sampling location with the submittals required in 6.01.03-6(f).

- (d) Additional field testing:** Additional field testing such as density and yield measurements may be required at the time of placement as determined by the Engineer.

5. Progression Cylinders and Compressive Strength Specimens: Progression Cylinders outlined in this section are field cured compressive strength specimens taken for information related to when a structure or segment of a structure can be loaded or put into service, adequacy of curing and protection of concrete in the structure, or when formwork or shoring may be removed from the structure. The information produced from strength results of Progression Cylinders will not be considered for acceptance of the concrete.

The personnel, equipment, and molds for sampling, casting, curing and testing of Progression Cylinders shall be furnished by the Contractor at no expense to the Department.

Sampling, casting, and field curing of the specimens shall be performed in accordance with AASHTO T23 by an ACI Concrete Field Testing Technician Grade 1 or higher and will be witnessed by a representative of the Department.

The sample shall be taken at the point of placement into the forms or molds from one (1) or more of the same truck loads that an Acceptance sample is taken from.

A minimum of two (2) cylinder results will be used to determine in-place strength.

Compression testing shall be performed in accordance with AASHTO T-22 by personnel approved by the Engineer.

A Certified Test Report in accordance with Article 1.06.07 shall be provided to the Engineer reporting the Progression Cylinder test results. A copy of the results of the compressive strength testing shall be provided to the Engineer at least twenty-four (24) hours prior to any Project activity that the results may control.

6. Handling and Placing Concrete: Concrete shall be handled, placed, and consolidated by methods acceptable to the Engineer that will not segregate the mix and shall result in a dense homogeneous concrete. The methods used shall not cause displacement of reinforcing steel or other materials to be embedded in the concrete. Concrete shall not be placed until the forms and all materials have been inspected by the Engineer. All mortar from previous placements, debris, and foreign material shall be removed from the forms and steel prior to commencing placement. The forms and subgrade shall be thoroughly moistened with water immediately before concrete is placed. All water that has ponded within the forms shall also be removed. Temporary form spreader devices shall not be left in place.

All laitance or unsound material shall be removed before placing substructure concrete onto the surface of any concrete placed underwater.

Placement of concrete for each section of the structure shall be performed continuously between construction or expansion joints as shown on the plans. The delivery rate, placing sequence and methods shall be such that fresh concrete is always placed and consolidated against previously placed concrete before initial set has occurred. The temperature of the concrete mixture during placement shall be maintained between 60°F (16°C) and 90°F (32°C). During and after placement of concrete, care shall be taken not to damage the concrete or break the bond with reinforcing steel. Platforms for workers and equipment shall not be supported directly on any reinforcing steel. Forces that may damage the concrete shall not be applied to the forms or reinforcing steel.

(a) Sequence of Placement: The sequence of placement shall be in accordance with the Contract documents or as permitted by the Engineer.

Concrete for integral horizontal members, such as caps, slabs, or footings shall not be placed until the concrete for the columns, substructure, culvert walls and similar vertical members has achieved sufficient strength as stated in 6.01.03-1(m).

The concrete in arches shall be placed in such a manner as to load the formwork uniformly and symmetrically.

The base slab or footings of cast-in-place box culverts shall reach sufficient strength before the remainder of the culvert is constructed.

(b) Placement Methods: The Contractor shall notify the Engineer at least twenty-four (24) hours in advance of intention to place concrete.

Vibrators shall not be used to shift the fresh concrete horizontally. Vibrators shall be adequate to consolidate the concrete and integrate it with the previous lift.

The rate of concrete placement must not produce loadings that exceed those considered in the design of the forms.

The use of chutes and pipes for conveying concrete into the forms must be reviewed by the Engineer. Chutes shall be clean, lined with smooth watertight material and, when steep slopes are involved, shall be equipped with baffles or reverses. When the discharge must be intermittent, a hopper or other device for regulating the discharge shall be provided.

Aluminum shall not be permanently incorporated into the concrete unless otherwise specified.

When placing operations involve dropping the concrete more than 5 feet (1500 mm), the Contractor shall take action to prevent segregation of the mix and spattering of mortar on steel and forms above the elevation of the lift being placed. This restriction shall not apply to cast-in-place pilings.

When using stay-in-place forms, concrete shall not be dropped more than 3 feet (1000 mm) above the top of the forms, and the concrete shall be discharged directly over the beams or girders.

- (c) **Pumping:** The Contractor shall use equipment specifically manufactured to pump concrete mixes and that meets the needs of the specific concrete placement.
- (d) **Consolidation:** Unless otherwise specified, all concrete, except concrete placed under water, shall be sufficiently consolidated by mechanical vibration immediately after placement.

The Contractor shall provide a sufficient number of commercially available mechanical immersion type vibrators to properly consolidate the concrete immediately after it is placed in the forms unless external form vibrators are used. The Contractor shall have an adequate number of operable vibrators available in case of breakdown.

External form vibrators may be used if submitted prior to concrete placement and reviewed by the Engineer.

Vibration shall not be applied directly to the reinforcement or hardened concrete. Special care shall be taken in placing and consolidating concrete around ornamental moulds, form liners and other embedded items. The vibrator shall not touch these items at any time.

- (e) **Additional Requirements for Bridge Decks:** At least fifteen (15) days before the erection of the screed rails, the Contractor shall submit screed erection plans, grades and sequence of concrete placement and proposed rate of placing concrete for review by the Engineer. These plans shall include details of equipment to be

used in the placement and finishing of the concrete, including the number and type of personnel who will be engaged in placing the concrete. The screed equipment shall be a commercially available vibratory system. The use of wooden screeds is prohibited.

When setting screed rails for mechanical finishing, the Contractor shall take into consideration and make proper allowances for the deflection of the bridge superstructure due to all operations.

Screed and runway supports shall not be located on any stay-in-place metal form sheets, form supports or reinforcing steel. The Contractor shall operate the mechanical screed at least twenty-four (24) hours prior to actual placement of the concrete to verify deck survey and equipment operations to the satisfaction of the Engineer.

Concrete shall be deposited in a uniform manner across the entire width being placed, and only two (2) passes of the transverse screed will be permitted over a given deck area, unless otherwise allowed by the Engineer.

If the Contractor proposes to place concrete outside of daylight hours, an adequate lighting system must be provided.

Concrete shall be deposited in accordance with the placement sequence as noted on the plans. If no sequence is indicated, the Contractor shall provide a placement sequence to the Engineer for review. The placement sequence shall proceed in such a manner that the total deflection or settlement of supporting members, and final finishing of the surface will occur before initial set of the concrete takes place.

At construction joints, concrete shall not be placed against the previously placed concrete for at least twelve (12) hours unless otherwise allowed by the Engineer.

- (f) Underwater Placement:** Concrete may only be placed under water within a cofferdam unless otherwise specified in the documents or otherwise allowed by the Engineer. Placement shall begin following inspection and acceptance of the depth and character of the foundation material by the Engineer.

Underwater concrete mixes are considered non-standard designs and shall be submitted to the Engineer for approval. Typically a minimum of ten percent (10%) additional cement than comparable non-underwater mixes will be required.

Underwater concrete shall be placed continuously with the surface of the concrete kept as horizontal as practical. To ensure thorough bonding, each succeeding layer shall be placed before the preceding layer has taken initial set. For large concrete placements, more than one (1) tremie or pump shall be used to ensure compliance with this requirement.

Mass concrete placement requirements, outlined in 6.01.03-6(g), do not apply to underwater concrete.

To prevent segregation, underwater concrete shall be placed in a compact mass, in its final position, by means of a tremie, concrete pump, or other approved method and shall not be disturbed. Still water shall be maintained at the point of deposit. Cofferdams shall be vented during the placement and curing of the concrete to equalize the hydrostatic pressure and thus prevent flow of water through the concrete.

If a tremie is used, the method of depositing the concrete shall be detailed in a working drawing submitted to the Engineer for review. The tube shall have watertight couplings and shall permit the free movement of the discharge end over the area of the work.

- (g) Mass concrete placement:** Mass concrete placement shall be defined as any placement, excluding underwater concrete placement, in which the concrete being cast has dimensions of 5 feet (1500 mm) or greater in each of three (3) different directions. For placements with a circular cross-section, a mass concrete placement shall be defined as any placement that has a diameter of 6 feet (1800 mm) or greater and a height of 5 feet (1500 mm) or greater. For all mass concrete placements, the mix temperature shall not exceed 85°F (30°C) as measured at point of discharge into the forms.

Any special concrete mix design proposed by the Contractor to meet the above temperature requirements shall be submitted to the Engineer for review.

7. Finishing Plastic Concrete: Unless otherwise specified in the Contract documents, after concrete has been consolidated and prior to final curing, all surfaces of concrete that are not placed against forms shall be struck-off to the planned elevation or slope. The surface shall be finished by floating with an acceptable tool. While the concrete is still in a workable state, all construction and expansion joints shall be tooled with an edger. Joint filler shall be left exposed. For requirements on float finish, refer to 6.01.03-10, "Finishing Concrete Surfaces."

After completion of the placing and finishing operation and for at least twelve (12) hours after the concrete has set, the Contractor shall not operate any equipment in the immediate vicinity of the freshly placed concrete if, in the opinion of the Engineer, it could cause excessive vibration, movement or deflection of the forms.

The addition of water to the surface of the concrete to assist in finishing operations will not be permitted.

- (a) Bridge Decks:** After the concrete has been consolidated and brought to the proper elevation by the screed machine, it shall be finished by use of a suitable float. The Contractor shall not disturb the fresh concrete after it has been finished. All finishing work, including the application of the fog spray and placement of the curing mats, shall be performed from work bridges supported above the deck surface. A work bridge shall be made available to the Engineer for inspection of the concrete work.

Surfaces that are to be covered with a waterproofing membrane shall be finished to a smooth surface, free of mortar ridges and other projections and in accordance with the membrane manufacturer's recommendations.

Unless otherwise noted in the Contract, the concrete wearing surfaces shall be given a skid-resistant texture by dragging, brooming, tining, or by a combination of these methods. These methods shall be done after floating and at such time and in such manner that the desired texture will be achieved while minimizing displacement of the larger aggregate particles.

1. Dragging: The surface shall be finished by dragging a seamless strip of damp burlap over the surface. The burlap to be dragged shall consist of sufficient layers and have sufficient length in contact with the concrete to slightly groove the surface. The burlap shall be drawn longitudinally along the surface in a slow manner so as to leave an even texture. The burlap shall be kept damp, clean, and free of particles of hardened concrete. The Contractor may propose an alternate material for the Engineer's consideration.
2. Tining: Tining shall be in a transverse direction using a wire broom, comb, or float having a single row of tines or fins. The tining grooves shall be between 1/16 inch (1.5 mm) and 3/16 inch (5 mm) wide and between 1/8 inch (3 mm) and 3/16 inch (5 mm) deep, spaced 1/2 inch (12.5 mm) to 3/4 inch (20 mm) on centers. Tining shall be discontinued 12 inches (300 mm) from the curb line on bridge decks. The area adjacent to the curbs shall be given a light broom finish longitudinally. As an alternative, tining may be achieved using a machine designed specifically for tining or grooving concrete pavements.

The transverse grooving shall be performed when the grooves can be formed to a maximum depth of 3/16 inch (5 mm) with relative ease and without the walls of the grooves closing in on each other. The tining shall be aligned so as to prevent overlapping of grooves in any two (2) successive transverse passes. The Contractor shall measure the depth of the grooves in the presence of the Engineer with an appropriate device to ensure compliance.

(b) Surface Testing and Correction: The completed surface shall be constructed in accordance with grades and cross slopes shown on the plans. The entire surface shall be checked by the Contractor in the presence of the Engineer, with an acceptable 10 foot (3 meter) straightedge.

1. The surface shall not vary more than +/- 1/8 inch (3 mm) in 10 feet (3 m) for decks which will not be covered with an overlay.
2. The surface shall not vary more than +/- 1/4 inch (6 mm) in 10 feet (3 m) for decks which will be covered with an overlay.

Variances greater than these, which, in the opinion of the Engineer, may adversely affect the riding qualities of the surface shall be corrected, and this shall be done at the expense of the Contractor. The Contractor shall submit a corrective procedure to the Engineer for review and approval. The procedure shall correct such irregularities by methods such as, but not limited to, concrete planing or grooving.

8. Bearing Surfaces: Concrete surfaces under metallic masonry plates and elastomeric bearings shall have a float finish. After the concrete has set, the area which will be in contact with the masonry plate shall be ground as necessary to provide full and even bearing. The finished surface shall not vary from a straightedge laid on the surface in any direction within the limits of the masonry plate by more than 0.0625 inches (1.5 mm). Surfaces which fail to conform shall be ground or filled until acceptable to the Engineer.

9. Curing Concrete: All newly placed concrete shall be cured so as to prevent loss of water by use of the methods specified. The Engineer may request that the Contractor furnish a curing plan.

The duration of the initial and final curing period in total shall continue uninterrupted for a minimum of seven (7) days.

(a) Curing Methods:

1. Forms-In-Place Method: Formed surfaces of concrete may be cured by retaining the forms in place without loosening. During periods of hot weather, water shall be applied to the forms until the Engineer determines that it is no longer required.
2. Water Method: Exposed concrete surfaces shall be kept continuously wet by ponding, spraying, or covering with materials that are kept continuously and thoroughly wet. Such materials may consist of cotton mats, multiple layers of burlap, or other approved materials that do not discolor or otherwise damage the concrete.
3. Waterproof Cover Method: This method shall consist of covering exposed surfaces with a waterproof sheet material to prevent moisture loss from the concrete. The concrete shall be wet at the time the cover is installed. The sheets shall be of the widest practicable width and adjacent sheets shall overlap a minimum of 6.0 inches (150 mm) to form a waterproof cover of the entire concrete surface and shall be adequately secured. Broken or damaged sheets shall be immediately repaired and the concrete shall be remoistened.

(b) Additional Requirements for Bridge Decks:

1. Curing Plan: The Contractor shall submit to the Engineer, at least fourteen (14) days prior to the placement of concrete for the bridge deck, a detailed curing plan that describes the following:
 - A. the initial and final curing durations,
 - B. equipment and materials to be used for curing concrete and monitoring concrete temperature, and
 - C. proposed primary and secondary water and heat sources

2. Initial Curing Period: A water fog spray shall be used by the Contractor from the time of initial placement until the final curing period begins. The amount of fog spray shall be strictly controlled so that accumulations of standing or flowing water on the surface of the concrete shall not occur.

Should atmospheric conditions render the use of fog spray impractical, the Contractor shall request approval from the Engineer to use a curing compound that meets the requirements of Section M.03 in lieu of a fog spray. The application shall be in accordance with the manufacturer's recommendation and be compatible with the membrane waterproofing.

3. Final Curing: After completion of finishing and as soon as any bleed water has dissipated and the concrete reaches sufficient strength to avoid marring, the Final curing period shall begin and the entire concrete surface shall be covered with water-retaining materials such as cotton mats, multiple layers of burlap, or other materials approved by the Engineer. Materials used shall be kept saturated by means of an acceptable sprinkler or wetting system.

The Contractor may cover the wet water-retaining material with a suitable polyethylene film to minimize evaporation during the curing period. The use of the polyethylene film does not relieve the Contractor from maintaining saturation of the curing materials.

4. Temperature Monitoring: The internal temperature of the concrete shall be monitored with a calibrated continuous recording thermometer for a minimum of seven (7) days. The air temperature at the concrete surface or the air temperature between the concrete surface and its protective covering shall be monitored with a minimum of one (1) recording thermometer.

The number and placement of the thermometers will be determined by the Engineer. A minimum of two (2) thermometers per concrete placement shall be provided by the Contractor.

The following types of thermometers shall be used to monitor curing temperatures:

- A. Continuously Recording Thermometer: The thermometer shall be capable of continuously recording temperatures within a range of -4 °F to 122 °F (-20°C to 50°C) for a minimum of twenty-four (24) hours.
- B. Maximum–Minimum Recording Thermometer: For all placements, the thermometer shall be capable of recording maximum and minimum temperatures in a range of -4 °F to 122 °F (-20°C to 50°C).

10. Finishing Concrete Surfaces: Any minor repairs due to fins, bulges, offsets and irregular projections shall be performed immediately following the removal of forms. For areas of newly placed concrete that are honeycombed or segregated the Contractor shall provide a written corrective procedure for review by the Engineer prior to the work being performed. Construction and expansion joints in the completed work shall be left

carefully tooled and free of mortar and concrete. The joint filler shall be left exposed for its full length with clean and true edges.

The cavities produced by form ties and all other holes, broken corners or edges, and other defects shall be cleaned, saturated with water, pointed and trued with a mortar conforming to M.11.04. Cement similar in color to the exposed surface being repaired shall be added to the mortar. Mortar used in pointing shall be used within one (1) hour of mixing. The concrete shall be finished as defined below if required and the cure continued as previously specified in "Curing Concrete."

Finishing work shall not interrupt the curing period unless permitted by the Engineer. The curing period may be extended to provide the minimum total number of days required.

Concrete surface finishes shall be classified as follows:

- (a) **Float Finish:** This finish shall be achieved by placing an excess of material in the form and removing or striking off of such excess forcing the coarse aggregate below the mortar surface. Concave surfaces in which water will be retained will not be allowed. After the concrete has been struck off, the surface shall be thoroughly worked and floated. Before this last finish has set, the surface shall be lightly stripped with a fine brush to remove the surface cement film, leaving a fine-grained, smooth, but sanded texture. Curing, as specified elsewhere, shall follow. Any surfaces that will support appurtenances such as light standards, railing, or fences shall be finished in accordance with 6.01.03-8, "Bearing Surfaces."
- (b) **Rubbed Finish:** The initial rubbing shall only be allowed within three (3) days after placement. The entire surface shall be thoroughly wet with a brush and rubbed with a No. 16 Carborundum Stone or an abrasive of equal quality, bringing the surface to a paste. The rubbing shall be continued sufficiently to remove all form marks and projections, producing a smooth, dense surface without pits or irregularities. The paste formed by the rubbing may be finished by stripping with a clean brush, or it may be spread uniformly over the surface and allowed to re-set. If all or portions of the rubbed surface are unacceptable to the Engineer or a rubbed finish is not provided within three (3) days after removal of forms, the Contractor will be directed to provide a grout clean down finish.
- (c) **Grout Clean-Down Finish:** As soon as all cavities have been filled as required elsewhere and the cement mortar has set sufficiently, grout clean-down shall be performed. All burrs, unevenness, laitance, including that in air holes, and any other material which will adversely affect the bond of the grout to the concrete, shall be removed by acceptable methods. This cleaning shall be done from the top or uppermost part of the surface to be finished to the bottom.

A mixture of a fine aggregate and Portland cement shall be thoroughly blended while dry. The proportions shall be such that when mixed with the proper amount of water, the color will match that of the concrete to be finished. Water shall be added to this mixture in an amount which will bring the grout to a workable thick paint-like consistency.

The surface to be treated shall be thoroughly wetted with a sufficient amount of water to prevent the absorption of water from the grout. Grout shall then be applied to the wetted surface before setting of the grout occurs. Grout which has set shall not be re-tempered and shall be disposed of by the Contractor at no cost to the State.

The grout shall be uniformly applied over the entire surface, completely filling all air bubbles and holes. Immediately after applying the grout, the surface shall be floated with a suitable float, scouring the surface vigorously. While the grout is still plastic, all excess grout shall be removed.

After the final rubbing is completed and the surface has dried, it shall be rubbed to remove loose powder and shall be left free from all unsound patches, paste, powder, and objectionable marks. Wetting, application and removal of excess grout shall be completed in one (1) work shift.

All finished surfaces shall be cured for a minimum of twenty-four (24) hours. Horizontal surfaces shall have a float finish and vertical exposed surfaces shall have a rubbed finish. A grout clean down finish may be substituted for a rubbed finish as noted in this section or as directed by the Engineer

11. Mortar, Grout, Epoxy and Joint Seal

- (a) Mortar and Grout:** This work consists of the making and placing of mortar and grout. At least forty-eight (48) hours prior to the planned use, a copy of the installation instructions and MSDS sheet(s) shall be provided to the Engineer for review and concurrence of their applicability and for verification of proper hole sizes in concrete structures. Such uses include mortar for filling under masonry plates, mortar used to fill voids and repair surface defects, grout used to fill sleeves for anchor bolts, and mortar and grout for other such uses where required or approved.

Concrete areas to be in contact with the mortar or grout shall be cleaned of all loose or foreign material that would in any way prevent bond, and the concrete surfaces shall be flushed with water and allowed to dry until no free-standing water is present.

The mortar or grout shall completely fill and shall be tightly packed into recesses and holes, on surfaces, under structural members, and at other locations specified. After placing, all surfaces of mortar or grout shall be cured as previously specified in 6.01.03-9(a)-2 "Curing Concrete – Water Method," for a period of not less than three (3) days.

- (b) Epoxy:** The epoxy shall be prepared and placed in accordance with the manufacturer's directions and with the equipment prescribed by the manufacturer. Instructions furnished by the supplier for the safe storage, mixing, handling and

application of the epoxy shall be followed. Contents of damaged or previously opened containers shall not be used.

- (c) Joint Seal:** This work consists of sealing joints where shown on the plans or as otherwise directed by the Engineer.

Before placement of the sealing material, the joints shall be thoroughly cleaned of all scale, loose concrete, dirt, dust or other foreign matter. Projections of concrete into the joint space shall be removed. The joint shall be clean and dry before the sealing compound is applied.

The joint sealant shall be prepared and placed in accordance with the manufacturer's directions and with the equipment prescribed by the manufacturer. The sealing compound shall be flush with, or not more than 1/8 inch (3 mm) above the adjacent surface of concrete, cutting off all excess compounds after the application. The joints shall be sealed in a neat and workmanlike manner and when the work is completed, the joints shall effectively seal against infiltration of moisture and water.

The Contractor shall arrange for, and have present at the commencement of the joint-sealing operation, a technically competent manufacturer's representative knowledgeable in the methods of installation of the sealant. The Contractor shall also arrange to have the representative present at such other times as the Engineer may request.

- (d) **Closed Cell Elastomer:** The closed cell elastomer shall be of the thickness, size and type specified and installed as shown on the plans and shall be in accordance with Section M.03.

12. Application of Loads: Loads shall not be applied to concrete structures until the concrete has attained sufficient strength and, when applicable, sufficient pre-stressing and post tensioning has been completed, so that damage will not occur. The means to determine when the concrete has attained sufficient strength shall be the use of Progression cylinders as defined elsewhere in this specification, or other means approved in advance by the Engineer.

- (a) **Earth Loads:** The placement of backfill shall not begin until the concrete is cured and has reached at least eighty percent (80%) of its specified strength unless otherwise permitted by the Engineer. The sequence of placing backfill around structures shall minimize overturning or sliding forces and flexural stresses in the concrete.
- (b) **Construction Loads:** Light materials and equipment may be hand carried onto bridge decks only after the concrete has been in place at least twenty-four (24) hours providing curing is not interfered with and the surface texture is not damaged.

Prior to the concrete achieving its specified compressive strength, any other live or dead loads imposed on existing, new, or partially completed portions of structures, shall not exceed the reduced load carrying capacity of the structure, or portion of structure. The Contractor may be required to submit calculations to the Engineer

that verify these requirements are being met. The compressive strength of concrete ($f'c$) to be used in computing the load-carrying capacity shall be the smaller of the actual field compressive strength at the time of loading or the specified design strength of the concrete. The means to determine the actual field compressive strength shall be approved by the Engineer.

For post-tensioned structures, no live or dead loads shall be allowed on any span until the steel for that span has been tensioned.

- (c) Loading of Completed Elements:** Precast concrete or steel girders shall not be placed on substructure elements until the substructure concrete has attained eighty-five percent (85%) of its specified strength.

No load shall be allowed on mortar or grout that has been in place less than seventy-two (72) hours.

- (d) Traffic Loads:** The concrete deck will not be opened to traffic until at least fourteen (14) days after the last placement of deck concrete and until such concrete has attained its specified strength.

13. Dispute Resolution: The basis of any dispute resolution is side-by-side and quality control testing by the Contractor or the Contractor's representative. The Contractor and Engineer should perform independent testing on the material to reasonably establish the true characteristics of the material at the time of delivery. Absent of Contractor QC testing, the Engineer's test results will apply to the quantity of concrete represented by the sample, not to exceed 75 cubic yards (60 cubic meters).

- (a) Air Content:** Contractor QC Testing must be performed by personnel qualified by The American Concrete Institute as an ACI Concrete Field Testing Technician Grade 1 or higher and performed in accordance with AASHTO T-23. If the Contractor's test results vary from those of the Engineer, the Contractor shall immediately notify the Engineer of the difference and work cooperatively to determine the reasonable cause and recognize the valid test. Should there be agreement, the result of the valid test will be used for acceptance and adjustment purposes for that lot of material. Should there not be an agreement as to the valid test, an additional set of tests should be performed. Results of all valid tests on the same lot may be averaged and used for acceptance and adjustment purposes. Should the Contractor wish to perform additional QC testing on subsequent material, the lot sizes may be adjusted to the amount of material included in that specific delivery. Any such QC testing must be witnessed and agreed to by the Engineer.

- (b) Compressive Strength:** Contractor QC testing for compressive strength must be performed in accordance with AASHTO T-22 by personnel approved by the Engineer. Samples used to dispute the Engineer's test results must be made simultaneously and from the same batch of concrete. Should the Contractor wish to pursue a dispute resolution with regard to compressive strength, the Contractor shall submit in writing to the Engineer all test results, control charts, or other documentation that may be useful in determining if the specific lot(s) of material met the Contract specifications. The Engineer will consider the submittal and may average specific test results on the disputed lot(s) for acceptance and adjustment purposes. Destructive testing of any kind on the placed concrete structure will not be allowed.

6.01.04—Method of Measurement: This work will be measured for payment as follows:

1. Concrete: The quantity of concrete will be the actual volume in cubic yards (cubic meters) of the specified class or classes, with the exception of underwater concrete, completed and accepted within the neat lines as shown on the plans or as ordered by the Engineer.

When concrete is placed against bedrock, a maximum of 6 additional inches (150 additional millimeters) beyond the neat lines can be measured for payment.

No deduction will be made for panels, form liners, reinforcing bars, structural steel shapes or for pile heads. There will be no deduction made for the volume occupied by culvert and drainage pipes, scuppers, weep holes, public utility structures or any other opening, unless the surface area of any such single opening is 9 square feet (1 square meter) or more.

In the case of culverts or drainage pipes, the computation of the surface area will be based on the nominal diameter of the pipe, disregarding the thickness of the shell.

Miscellaneous materials necessary for completion of the work such as felt, mortar, grout, epoxy, joint seal, paraffin coating and closed cell elastomer will not be measured for payment.

Incidental work such as forming for anchor bolts, utilities, keyways, and sampling and testing will not be measured for payment.

2. Underwater Concrete: When underwater concrete is used, it will be measured by the volume in cubic yards (cubic meters) within the actual horizontal limits of the cofferdam and between the elevations established by the Engineer.

3. Joint Filler: This material will be measured by the area in square feet (square meters) of the joint filler, of the type and thickness specified, actually installed and accepted.

6.01.05—Basis of Payment: Payment for this work will be made as follows:

1. Concrete: Progress payments may be allowed for completed major labor elements of work such as forming, placing and curing. Prior to placement, the Contractor shall submit a proposed schedule of values for review and approval by the Engineer.

Payment for any lot of concrete allowed to remain in place will be adjusted when the field and laboratory testing of the material is completed. The quantity of concrete in each lot will be a maximum of 75 cubic yards (60 cubic meters). Payment for each lot of concrete will be adjusted based on the results of the Acceptance testing performed by the Engineer.

The following pay factors apply for Standard and Modified Standard Mix classes with regard to entrained air content:

Air Pay Factors

Measured air (%)		Pay factor (%)
4.5 to 7.5		1.00 (100)
4.3 and 4.4	7.6 and 7.7	0.98 (98)
4.1 and 4.2	7.8 and 7.9	0.96 (96)
3.9 and 4.0	8.0 and 8.1	0.94 (94)
3.7 and 3.8	8.2 and 8.3	0.92 (92)
3.5 and 3.6	8.4 and 8.5	0.90 (90)
Concrete lots with less than 3.5% or greater than 8.5% entrained air will be rejected.		

The following pay factors apply for Standard and Modified Standard Mix classes with regard to compressive strength:

Strength Pay Factors

Compressive Strength (%)	Pay factor (%)
95 or greater	1.00 (100)
90 to 94.9	0.95 (95)
85 to 89.9	0.90 (90)
Concrete lots with less than 85% specified strength will be rejected.	

The payment adjustment value for entrained air and 28-day strength for any lot of concrete that is allowed to remain in-place is determined using the formulas below. An index price of \$400.00 per c.y. (cu.m) shall be used to calculate each adjustment. The total adjustment value will be the sum of each individual adjustment value and will be deducted from the payment for the appropriate item.

English Units:	Metric Units:
Adjustment (air) = (1 - air pay factor) x \$400/c.y. x lot size (c.y.)	Adjustment (air) = (1 - air pay factor) x \$400/cu.m x lot size (cu.m)
Adjustment (strength) = (1 - strength pay factor) x \$400/c.y. x lot size (c.y.)	Adjustment (strength) = (1 - strength pay factor) x \$400/cu.m x lot size (cu.m)
Total Adjustment = Adjustment (air) + Adjustment (strength)	

The Contractor shall request permission from the Engineer to remove and replace a lot(s) of concrete to avoid a negatively adjusted payment. Any replacement material will be sampled, tested and evaluated in accordance with this specification.

No direct payment will be made for any labor, equipment or materials used during the sampling and testing of the concrete for Progression or Acceptance. The cost shall be considered as included in the general cost of the work or as stated elsewhere in the Contract. The work of transporting the concrete test specimens, after initial curing, for Acceptance testing will be performed by the Department without expense to the Contractor.

This material will be paid for at the Contract unit price per cubic yard (cubic meter) less any adjustments, for the specified class or classes, complete in place, which price shall include all materials, equipment, tools, labor and work incidental thereto, including heating, all admixtures, joint sealer, roofing felt and closed cell elastomer, and any miscellaneous materials such as metal flashing and metal used in expansion joints and bearings.

2. Underwater Concrete: When this class of concrete is used, it will be paid for at the Contract unit price per cubic yard (cubic meter) for "Underwater Concrete," complete in place, which price shall include all materials, equipment, tools, labor and work incidental thereto.

3. Joint Filler: Expansion joint filler will be paid for at the Contract unit price per square foot (square meter) for "Joint Filler for Bridges" of the type and thickness specified, complete in place, which price shall include all materials, equipment, tools, labor and work incidental thereto.

<u>Pay Item</u>	<u>Pay Unit</u>
Concrete (Class A, C, F)	c.y. (cu.m)
Underwater Concrete	c.y. (cu.m)
Joint Filler for Bridges (Thickness and Type)	s.f. (s.m.)

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 6.03
STRUCTURAL STEEL**

Delete the entire section and replace it with the following:

**SECTION 6.03
STRUCTURAL STEEL**

6.03.01—Description: Work under this item shall consist of furnishing, fabricating, transporting, storing, handling and erecting of structural steel of the type and size designated, as shown on the plans, as directed by the Engineer and in accordance with these Specifications.

All work except as stated in the following paragraph shall conform to the requirements of the AASHTO LRFD Bridge Construction Specifications and the ANSI/AASHTO/AWS D1.5 – Bridge Welding Code.

All work subject to railroad loading shall conform to AREMA and the ANSI/AASHTO/AWS D1.5 – Bridge Welding Code.

6.03.02—Materials: The materials for this work shall conform to the requirements of Section M.06.

Materials for this work shall be stored off the ground before, during, and after fabrication. It shall be kept free from dirt, grease and other contaminants and shall be reasonably protected from corrosion. In addition, weathering steel shall be stored as to allow free drainage and promote the development of the oxide coating and a uniform appearance.

6.03.03—Construction Methods:

1. Pre-qualification:

(a) Fabricators producing material for Department projects under this item are required to have as a minimum, an active AISC Certification for Simple Steel Bridges. For fabrication of material for use on bridges other than un-spliced rolled beam bridges, AISC Major Steel Bridge Certification is required. If so noted on the plans, additional AISC endorsement for fabrication of fracture critical members is also required.

(b) Field Welders: Prior to working on material for Department projects under this Specification, all field welders, field welding operators, and field tackers must possess a valid welder certification card issued by the Department's Division of

Materials Testing. If such person has not been engaged in welding operations on a Department project or project acceptable to the Department within a period of six (6) months, or cannot produce an approved welding certificate dated within the previous twelve (12) months from a welding agency acceptable to the Engineer, the field welder shall be required to re-qualify through examination. The Engineer may require re-qualification of anyone whose quality of work is in question.

2. Submittals:

(a) Shop Drawings: Prior to any fabrication, the Contractor shall submit shop drawings in accordance with Article 1.05.02 to the Engineer for review. Shop drawings shall include a cambering procedure and diagram. In the case of trusses, the Contractor is responsible for calculation of the camber (lengthening and shortening) of all truss members.

(b) Shop Schedule: The Contractor shall submit a detailed shop fabrication schedule to the Engineer for review within 30 days of the Notice to Proceed unless otherwise agreed to by the Engineer. At a minimum the schedule shall include the start date, milestone dates, and completion date. Any significant changes shall be brought to the attention of the Engineer immediately.

(c) Welding Procedures: Prior to start of fabrication, all welding procedures shall be submitted to the Engineer for review.

(d) Working Drawings for Falsework and Erection of Structural Steel: Prior to erecting any steel fabricated under this Specification, the Contractor shall submit drawings and supporting calculations, including erection stresses, in accordance with Article 1.05.02 to the Engineer. The design of temporary supports and falsework shall conform to the *AASHTO Specifications*, the *AASHTO Guide Design Specifications for Bridge Temporary Works* or any other standard acceptable to the Engineer. Falsework shall be of sufficient rigidity and strength to safely support all loads imposed and to produce in the finished structure the lines and grades indicated in the Contract.

The working drawings submittal shall include at a minimum:

- Title block with Contract number, Project identification number (PIN), town, and structure number and name.
- Plan of the work area showing support structures, roads, railroad tracks, Federal and State regulated areas as depicted on the plans, utilities or any other information relative to erection.
- A detailed narrative describing the erection sequence for main members and secondary members (cross frames, diaphragms, lateral bracing, portals, etc.), noting use of holding cranes or temporary supports, falsework, or bents.
- Delivery location of each girder.
- Location of each crane for each pick.
- Capacity chart for each crane and boom length used in the work.
- The capacity of the crane and of all lifting and connecting devices shall be adequate for the total pick load including spreaders and other materials. In the area of railroads and navigable waterways, the capacity shall be as

required by Amtrak, Metro North, U.S. Coast Guard or other regulatory authorities. No picks shall be allowed over vehicular or pedestrian traffic unless otherwise noted on the plans or permitted by the Engineer.

- Pick point location(s) on each member.
- Lifting weight of each member including clamps, spreader beams, etc.
- Lift and setting radius for each pick (or maximum lift radius).
- Description of lifting devices or other connecting equipment.
- Girder tie-down details or other method of stabilizing erected girders.
- Bolting requirements, including the minimum number of bolts and erection pins required to stabilize members during the erection sequence.
- Blocking details for stabilizing members supported on expansion bearings and on bearings that do not limit movement in the transverse direction.
- The method and location for temporary supports for field spliced or curved girders, including shoring, false work, holding cranes, guys, etc. The Engineer will review, but not approve details of temporary supports. The design, erection, and stability of these supports shall be the sole responsibility of the Contractor.
- Offsets necessary to adjust expansion bearings during erection to provide for temperature variance and dead load rotation.

The following notes shall be placed on the Erection Drawings:

- Cranes shall be operated in accordance with the Connecticut Department of Public Safety regulations.
- The Contractor shall be responsible for verifying the weight of each lift and for insuring the stability of each member during all phases of erection.
- Members shall be subject to only light drifting to align holes. Any drifting that results in distortion of the member or damage to the holes will be cause for rejection of the member.
- Field reaming of holes shall not be performed unless required by the Contract Drawings or approved by the Engineer.

The Contractor shall submit these documents to the Engineer at least sixty (60) calendar days in advance of their proposed use. If the proposed method of erection requires additional members or modifications to the existing members of the structure, such additions and modifications shall be made by the Contractor at no expense to the State.

3. Shop Fabrication: Unless otherwise shown on the plans or indicated in the Special Provisions, Structural Steel shall be fabricated in accordance with the AASHTO LRFD Bridge Construction Specifications, amended as follows:

(a) Notification: The Contractor shall submit written notification to both the Engineer and the Division Chief (OOC) not less than thirty (30) calendar days prior to start of fabrication. No material shall be manufactured or worked in the shop before the Engineer has been so notified. The notification shall include the name and location of the fabrication shop where the work will be done so that arrangements can be made for an audit of the facility and the assignment of a Department Quality Assurance inspector.

(b) Camber: All members shall be cambered prior to heat curving and painting. Rolled beams shall be heat cambered by methods approved by the Engineer. Plate girders shall be cambered by cutting the web to the prescribed shape with allowances for shrinkage due to cutting, welding, and heat curving. The fabricator is responsible to determine what allowances should be made. Rolled, plate-rolled, or fabricated sections shall be cambered to the total amount shown on the plans and within the camber deviation tolerances permitted for welded beams and girders, as indicated in the ANSI/AASHTO/AWS D1.5 Bridge Welding Code. The Contractor must submit to the Engineer for approval, a plan for corrective action if the actual camber is not within tolerance.

(c) Welding: Unless otherwise indicated in the Contract, all work shall be performed in accordance with ANSI/AASHTO/AWS D1.5 – Bridge Welding Code.

(d) Preassembly of Field Connections: Field connections of main members of continuous beams, plate girders, bents, towers, rigid frames, trusses and arches shall be preassembled prior to erection as necessary to verify the geometry of the completed structure or unit and to verify or prepare field splices. The Contractor shall propose an appropriate method of preassembly for review and comment by the Engineer. The method and details of preassembly shall be consistent with the erection procedures shown on the working drawings and camber diagrams. As a minimum, the preassembly procedure shall consist of assembling three (3) contiguous panels accurately adjusted for line and camber. Successive assemblies shall consist of at least one (1) section or panel of the previous assembly plus two (2) or more sections or panels added at the advancing end. In the case of structures longer than 150 feet (45 meters), each assembly shall not be less than 150 feet (45 meters) long regardless of the length of individual continuous panels or section. All falsework, tools, machinery and appliances, including drift pins and bolts necessary for the expeditious handling of the work shall be provided by the Contractor at no cost to the State.

(e) Inspection: The Contractor shall furnish facilities for the inspection of material and workmanship in the shop by the Engineer. The Engineer and his representative shall be allowed free access to the necessary parts of the premises.

The Engineer will provide Quality Assurance (QA) inspection at the fabrication shop to assure that all applicable Quality Control plans and inspections are adequately adhered to and maintained by the Contractor during all phases of the fabrication. A thorough inspection of a random selection of elements at the fabrication shop may serve as the basis of this assurance.

Prior to shipment to the Project, each individual piece of structural steel shall be stamped or marked in a clear and permanent fashion by a representative of the fabricator's Quality Control (QC) Department to indicate complete final inspection by the fabricator and conformance to the Project specifications for that piece. The stamp or mark must be dated. A Materials Certificate in accordance with Article 1.06.07 may be used in lieu of individual stamps or markings, for all material in a

single shipment. The Materials Certificate must list each piece within the shipment and accompany the shipment to the Project Site.

Following the final inspection by the fabricator's QC personnel, the Engineer may select pieces of structural steel for re-inspection by the Department's QA inspector. Should non-conforming pieces be identified, all similar pieces must be re-inspected by the fabricator and repair procedure(s) submitted to the Engineer for approval. Repairs will be made at the Contractor's expense.

The pieces selected for re-inspection and found to be in conformance, or adequately repaired pieces, may be stamped or marked by the QA inspector. Such markings indicate the Engineer takes no exception to the pieces being sent to the Project Site. Such marking does not indicate acceptance or approval of the material by the Engineer.

Following delivery to the Project Site, the Engineer will perform a visual inspection of all material to verify shipping documents, fabricator markings, and that there was no damage to the material or coatings during transportation and handling.

The Engineer is not responsible for approving or accepting any fabricated materials prior to final erection and assembly at the Project Site.

(f) Nondestructive Testing: All nondestructive testing of structural steel and welding shall be performed as designated in the plans and specifications. Such testing shall be performed by personnel approved by the Engineer.

Personnel performing Radiographic, Ultrasonic or Magnetic Particle testing shall be certified as a NDT Level II technician in accordance with the American Society for Non Destructive Testing (ASNT), Recommended Practice SNT-TC-1A.

Nondestructive testing shall be performed in accordance with the procedures and standards set forth in the AASHTO/AWS D1.5, Bridge Welding Code. The Department reserves the right to perform additional testing as determined by the Engineer.

All nondestructive testing shall be witnessed by an authorized representative of the Department. Certified reports of all tests shall be submitted to the Division of Materials Testing for examination. Each certified report shall identify the structure, member, and location of weld or welds tested. Each report shall also list the length and location of any defective welds and include information on the corrective action taken and results of all retests of repaired welds.

Should the Engineer require nondestructive testing on welds not designated in the Contract, the cost of such inspection shall be borne by the Contractor if the testing indicates that any weld is defective. If the testing indicates the weld to be satisfactory, the actual cost of such inspection will be paid for by the Department.

(g) Marking: Each member shall be identified with an erection mark corresponding with the member identification mark on the approved shop drawings. Identification marks shall be impressed into the member with a low stress stamp in a location in accordance with standard industry practice.

(h) Shipping, Handling, Storage and Receiving: The Contractor shall make all arrangements necessary to properly load, transport, unload, handle and store all material. The Contractor shall furnish to the Engineer copies of all shipping statements. The weight (mass) of the individual members shall be shown on the statements. Members having a weight (mass) of more than 3 tons (2700 kilograms) shall have the weight (mass) marked thereon. All material shall be unloaded promptly upon delivery. The Contractor shall be responsible for any demurrage charges. Damage to any material during transportation, improper storage, faulty erection, or undocumented fabrication errors may be cause for rejection of said material at the Project Site. Top lateral bracing shall be installed in tub girders prior to shipping and erection of the field pieces. All costs associated with any corrective action will be borne by the Contractor.

4. Field Erection: A meeting shall be held on Site prior to any erection of structural steel. The Contractor shall name the person responsible for the steel erection work and provide copies of all crane operator licenses. Proposed equipment, rigging, timetable and methods shall be proposed at this meeting.

(a) Falsework: Any temporary work shall be constructed in conformance with the working drawings. The Contractor shall verify that the quality of materials and work employed are consistent with their design.

All girders shall be stabilized with falsework, temporary braces, or holding cranes until a sufficient number of adjacent girders are erected with all diaphragms and cross frames connected to provide necessary lateral support as shown in the erecting diagrams.

Adjustment shall be provided in the falsework and other temporary supports so that the temporary elevation of the structural steel provided by the falsework is consistent with the deflections that will occur as the structure is completed. The elevation of falsework shall be such as to support the girders at the cambered no-load elevation. Unloading of temporary supports shall be performed such that all temporary supports at each cross section are unloaded uniformly. Unless specifically permitted by the Engineer, welding of falsework support brackets to structural steel is not allowed.

Unless erected by the cantilever method, truss spans shall be erected on blocking. The blocking shall be left in place until the tension chord splices are fully bolted and all other truss connections pinned and bolted and the proper geometric shape is achieved.

(b) Anchorages: Anchor bolts and similar materials which are to be placed during the erection of the structural steel shall be carefully and accurately set to the requirements of Article 6.01.03.

(c) Bearings: Bearing plates shall have a full and uniform bearing upon the substructure masonry. Bearing plates shall be placed upon bearing areas which are finished according to the requirements of Article 6.01.03.

Prefabricated pads conforming to the requirements of Article M.12.01 shall be installed unless specifically noted otherwise in the Contract plans.

Each piece shall be the same size as the bearing plate it is to support and the holes to accommodate the anchor bolts shall be clearly and accurately punched before setting the pad in place.

In placing expansion bearings, due consideration shall be given to the temperature at the time of erection and stage construction requirements. The nuts of anchor bolts at expansion bearings shall be adjusted to permit the free movement of the span.

(d) Field Assembly: Members and components shall be accurately assembled as shown on the plans and any match marks shall be followed. The material shall be carefully handled so that no components will be bent, broken or otherwise damaged.

Hammering which will injure or distort the members is not permitted. Bearing surfaces and surfaces to be in permanent contact shall be cleaned before the members are assembled.

Cylindrical erection pins shall be 1/32 inch (0.8 mm) larger than the nominal diameter of the holes.

Splices and field connections of main stress carrying members shall be made with a minimum of fifty percent (50%) of the holes filled and tightened with high strength bolts before the lifting system is released. The bolts shall be installed uniformly throughout the connection. Lateral stability must be maintained until the deck is placed.

The Contractor shall ensure that girders are stable throughout the erection process. The stage of completeness of the bolted connections shall be considered when evaluating the strength and stability of the steel during erection. For Closed Box and Tub Girders the Contractor shall ensure that the cross-section shape of each box is maintained during erection. Top lateral bracing shall be installed in tub girders prior to shipping and erection of the field pieces.

(e) Welded Connections: Unless otherwise shown on the plans or indicated by the special provisions, welding of structural steel shall be done in accordance with "ANSI/AASHTO/AWS D1.5 Bridge Welding Code."

The Contractor's welding and inspection procedures for each type of field weld and field tacking must be submitted to the Engineer on the form designated by the Department. All procedures must be approved by the Division of Materials Testing prior to any work and must be adhered to at all times.

Quality control is the responsibility of the Contractor. The Contractor must provide an AWS Certified Welding Inspector (CWI) in accordance with AWS D1.5. The CWI must be qualified and certified in accordance with the provisions of AWS QC1, *Standard for Qualification and Certification of Welding Inspectors*.

The CWI shall make visual inspection of all welds. The Contractor shall perform magnetic particle inspection, ultrasonic testing inspection, or radiographic testing inspection of field welds when required in the plans or special provisions. Each test may be witnessed by an authorized representative of the Engineer.

Welds or sections of welds containing imperfections determined to be unacceptable by either the CWI or the Engineer shall be removed and re-welded by the Contractor at their expense. Welds so removed and replaced shall be re-inspected by the CWI. All costs for re-inspection or testing of such welds shall be borne by the Contractor.

(f) High Strength Bolted Connections: The assembly of structural connections using ASTM A 325/ A 325M or ASTM A 490/A 490M high-strength bolts shall be installed so as to develop the minimum required bolt tension specified in Table A. The Manufacturer's certified test report, including the rotational capacity test results, **must** accompany the fastener assemblies. Fastener assemblies delivered without the certified reports will be rejected.

Bolts, nuts and washers from each rotational-capacity lot shall be shipped in the same container. If there is only one production lot number for each size of nut and washer, the nuts and washers may be shipped in separate containers. Each container shall be permanently marked with the rotational-capacity lot number such that identification will be possible at any stage prior to installation. Assemblies of bolts, nuts and washers shall be installed from the same rotational-capacity lot. Pins, small parts and packages of bolts, washers, and nuts shall be shipped in boxes, crates, kegs, or barrels. A list and description of the contained materials shall be plainly marked on the outside of each shipping container.

Bolted Parts: All material within the grip of the bolt shall be steel; there shall be no compressible material, such as gaskets or insulation, within the grip. Bolted steel shall fit solidly together after the bolts are tensioned. The length of the bolts shall be such that the end of the bolt will be flush with or outside of the face of the nut when properly installed.

Surface Conditions: At the time of assembly, all connection surfaces, including surfaces adjacent to the bolt head and nut, shall be free of scale, except tight mill scale, and shall be free of dirt or other foreign material. Burrs that would prevent solid seating of the connected parts in the snug tight condition shall be removed.

Paint is permitted on the faying surface, including slip critical connections, only when shown on the plans. The faying surfaces of slip-critical connections shall meet the requirements of the following paragraphs, as applicable:

- Connections specified to have un-coated faying surfaces: any paint, including any inadvertent over spray, shall be excluded from areas closer than one (1) bolt diameter, but not less than 1.0 in (25 mm), from the edge of any hole and all areas within the bolt pattern.
- Connections specified to have painted faying surfaces shall be blast cleaned and coated in accordance with the Contract, and shall not be assembled until the coating system has been properly cured.
- Connections specified to have galvanized faying surfaces shall be hot-dip galvanized in accordance with ASTM A 123/A 123M, and shall subsequently be roughened by means of hand wire brushing. Power wire brushing is not permitted.

Installation: At the pre-erection meeting, the Contractor shall inform the Engineer of its planned method of tensioning high strength bolts. Acceptable methods are: Turn-of-Nut, Calibrated Wrench or Direct Tension Indicator.

Fastener Assemblies: A "fastener assembly" is defined as a bolt, a nut, and a washer. Only complete fastener assemblies of appropriately assigned lot numbers shall be installed.

Fastener assemblies shall be stored in an area protected from dirt and moisture. Only as many fastener assemblies as are anticipated to be installed and tensioned during a work shift shall be taken from protected storage. Fastener assemblies not used shall be returned to protected storage at the end of the shift. Prior to installation, fastener assemblies shall not be cleaned of lubricant. Fastener assemblies which accumulate rust or dirt resulting from site conditions shall be cleaned, relubricated and tested for rotational-capacity prior to installation. All galvanized nuts shall be lubricated with a lubricant containing a visible dye. Plain bolts must be oily to the touch when delivered and installed. Lubricant shall be removed prior to painting.

All bolts shall have a hardened washer under the turned element (nut or bolt head). All hardened washers shall conform to the requirements of ASTM F 436/F 436M.

Where necessary, washers may be clipped on one side to a point not closer than 7/8 of the bolt diameter from the center of the washer. Circular and beveled washers, when used adjacent to direct tension indicator washers shall not be clipped. Direct tension indicator washers shall not be clipped.

Bolt Tension Measuring Device: The Contractor shall provide a calibrated bolt tension measuring device (a Skidmore-Wilhelm calibrator (Skidmore) or other acceptable bolt tension indicating device) at all times when, and at all locations where high-strength fasteners are being installed and tensioned. The tension measuring device (Skidmore) shall be calibrated by an approved testing agency at least annually. The Skidmore shall be used to perform the rotational-capacity test of the fastener assemblies. The Skidmore will also be used to substantiate (1) the suitability of the fastener assembly to satisfy the requirements of Table A, including lubrication as required, (2) calibration of the installation wrenches, if applicable, and (3) the

understanding and proper use by the Contractor of the selected method of tensioning to be used.

Complete fastener assemblies shall be installed in properly aligned holes and then tensioned by the Turn-of-Nut, Calibrated Wrench or Direct Tension Indicator method to the minimum tension specified in Table A. Tensioning may be done by turning the bolt while the nut is prevented from rotating when it is impractical to turn the nut. Impact wrenches, if used, shall be of adequate capacity and sufficiently supplied with air to perform the required tensioning of each bolt in approximately ten (10) seconds.

Bolts shall be installed in all holes of the connection and the connection brought to a snug condition. Snug is defined as having all the plies of the connection in firm contact. Snugging shall progress systematically from the most rigid part of the connection to the free edges. The bolts of the connection shall then be tightened in a similar manner as necessary until the connection is properly tensioned.

Nuts shall be located, whenever practical, on the side of the connection which will not be visible from the traveled way.

Unless otherwise approved by the Engineer fastener assemblies shall be brought to full tension immediately following snugging.

Fully tensioned fastener assemblies shall not be reused. Retightening previously tensioned bolts which may have been loosened by the tensioning of adjacent bolts shall not be considered as reuse.

Rotational-Capacity Tests: In addition to the certified test reports, on site Rotational-capacity tests may be required by the Engineer. This test shall be performed by the Contractor at the location where the fasteners are installed and tensioned. When performed in the field, the procedure shall conform to the requirements of ASTM A 325/ A 325M Appendix A-1.

Turn-of-Nut Installation Method: At the start of the work, the Contractor shall demonstrate that the procedure used by the bolting crew to develop a snug condition and to control the turns from a snug condition develops the tension required in Table A. To verify their procedure, the Contractor shall test a representative sample of not less than three complete fastener assemblies of each diameter, length and grade to be used in the work. This shall be performed at the start of work using a Skidmore. Periodic retesting shall be performed when ordered by the Engineer.

After snugging the connection, the applicable amount of rotation specified in Table B shall be achieved. During the tensioning operation there shall be no rotation of the part not turned by the wrench. Tensioning shall progress systematically from the most rigid part of the connection to its free edges.

Calibrated Wrench Installation Method: Calibrated wrench method may be used only when the installation wrenches are properly calibrated daily, or as determined by the Engineer. Standard torques determined from tables or from formulas which are assumed to relate torque to tension **shall not** be acceptable.

The Contractor shall demonstrate to the Engineer periodically that all equipment and wrenches are providing a torque which has been calibrated to produce the minimum tension specified in Table A. The installation procedures shall be verified periodically, as determined by the Engineer, for each bolt diameter, length and grade using the fastener assemblies that are being installed in the work. This verification testing shall be accomplished in a Skidmore by tensioning three (3) complete fastener assemblies of each diameter, length and grade from those being installed with a hardened washer under the element turned.

When significant difference is noted in the surface condition of the bolts, threads, nuts or washers, as determined by the Engineer, wrenches shall be recalibrated. The Contractor shall verify during the installation of the assembled steel work that the wrench adjustment selected by the calibration does not produce a nut or bolt head rotation from snug greater than that permitted in Table B. If manual torque wrenches are used, nuts shall be turned in the tensioning direction when torque is measured.

When calibrated wrenches are used to install and tension bolts in a connection, bolts shall be installed with hardened washers under the element turned to tension the bolts. Once the connection has been snugged, the bolts shall be tensioned using the calibrated wrench. Tensioning shall progress systematically from the most rigid part of the connection to its free edges. A calibrated torque wrench shall be used to "touch up" previously tensioned bolts which may have been relaxed as a result of the subsequent tensioning of adjacent bolts until all bolts are tensioned to the prescribed amount.

Direct Tension Indicator Installation Method: When Direct Tension Indicators (DTIs) meeting the requirements of Section M.06 are used with high-strength bolts to indicate bolt tension, they shall be subjected to the verification testing described below and installed in accordance with the method specified below. Unless otherwise approved by the Engineer, the DTIs shall be installed under the head of the bolt and the nut turned to tension the bolt. The Manufacturer's recommendations shall be followed for the proper orientation of the DTI and additional washers, if any, required for the correct use of the DTI. Installation of a DTI under the turned element may be permitted if a washer is used to separate the turned element from the DTI.

Verification: Verification testing shall be performed in a Skidmore. A special flat insert shall be used in place of the normal bolt head holding insert. Three verification tests shall be required for each combination of fastener assembly rotational-capacity lot, DTI lot, and DTI position relative to the turned element (bolt head or nut) to be used on the Project. The fastener assembly shall be installed in the tension-measuring device with the DTI located in the same position as in the work. The element intended to be stationary (bolt or nut) shall be restrained from rotation.

The verification tests shall be conducted in two stages. The bolt nut and DTI assembly shall be installed in a manner so that at least three (3) and preferably not more than five (5) threads are located between the bearing face of the nut and the bolt head. The bolt shall be tensioned first to the load equal to that listed in Table C under Verification Tension for the grade and diameter of the bolt. If an impact wrench is used, the tension developed using the impact wrench shall be no more than two-thirds (2/3) of the required tension. Subsequently, a manual wrench shall be used to attain the required tension. The number of refusals of the 0.005 in (0.125 mm) tapered feeler gage in the spaces between the protrusions shall be recorded. The number of refusals for uncoated DTIs under the stationary or turned element, or coated DTIs under the stationary element, shall not exceed the number listed under Maximum Verification Refusals in Table C for the grade and diameter of bolt used. The maximum number of verification refusals for coated DTIs (galvanized, painted, or epoxy-coated), when used under the turned element, shall be no more than the number of spaces on the DTI less one. The DTI lot shall be rejected if the number of refusals exceeds the values in the table or, for coated DTIs if the gage is refused in all spaces.

After the number of refusals is recorded at the verification load, the bolt shall be further tensioned until the 0.005 in (0.125 mm) feeler gage is refused at all the spaces and a visible gap exists in at least one space. The load at this condition shall be recorded and the bolt removed from the tension-measuring device. The nut shall be able to be run down by hand for the complete thread length of the bolt excluding thread run-out. If the nut cannot be run down for this thread length, the DTI lot shall be rejected unless the load recorded is less than ninety-five percent (95%) of the average load measured in the rotational capacity test of the fastener lot as specified previously in "Rotational-Capacity Tests."

If the bolt is too short to be tested in the calibration device, the DTI lot shall be verified on a long bolt in a calibrator to determine the number of refusals at the verification tension listed in Table C. The number of refusals shall not exceed the values listed under maximum verification refusals in Table C. Another DTI from the same lot shall then be verified with the short bolt in a convenient hole in the work. The bolt shall be tensioned until the 0.005 in. (0.125 mm) feeler gage is refused in all spaces and a visible gap exists in at least one space. The bolt shall then be removed from the tension-measuring device and the nut shall be able to be run down by hand for the complete thread length of the bolt excluding thread run-out. The DTI lot shall be rejected if the nut cannot be run down this thread length.

Installation: Installation of fastener assemblies using DTIs shall be performed in two stages. The stationary element shall be held against rotation during each stage of the installation. The connection shall be first snugged with bolts installed in all holes of the connection and tensioned sufficiently to bring all the plies of the connection into firm contact. The number of spaces in which a 0.005 in (0.125 mm) feeler gage is refused in the DTI after snugging shall not exceed those listed under Maximum Verification Refusals in Table C. If the number exceeds the values in the table, the fastener assembly shall be removed and another DTI installed and snugged.

For uncoated DTIs used under a stationary or turned element and for coated DTIs used under a stationary element, the bolts shall be further tensioned until the number of refusals of the 0.005 in. (0.125 mm) feeler gage shall be equal or greater than the number listed under Minimum Installation Refusals in Table C. If the bolt is tensioned so that no visible gap in any space remains, the bolt and DTI shall be removed and replaced by a new properly tensioned bolt and DTI.

When coated DTIs (galvanized, painted or epoxy coated) are used under a turned element, the 0.005 in (0.125 mm) feeler gage shall be refused in all spaces.

Inspection: The Contractor shall provide all the material, equipment, tools and labor necessary for the inspection of the bolted connections. Access to the bolted parts and fastener assemblies, both before and after the fasteners are installed and tensioned, shall be provided.

The Contractor is responsible for Quality Control (QC). The Contractor shall review this Specification with its project personnel prior to performing the work. The Contractor shall verify the proper markings, surface conditions and storage of fastener assemblies. The Contractor shall inspect the faying surfaces of connections for compliance with the plans and specifications. The Contractor shall provide to the Engineer a copy of their written QC Report for each shift of the calibration or verification testing specified. This Report shall confirm that the selected procedure is properly used and that the fastener assemblies installed meet the tensions specified in Table A. The Contractor shall monitor the installation of fasteners in the work to assure that the selected procedure, as demonstrated in the initial testing to provide the specified tension, is routinely and properly applied.

The Contractor, in the presence of the Engineer, shall inspect the tensioned bolts using an inspection torque wrench, as defined below. If DTI devices are used, the appropriate feeler gauge will be used. Inspection tests shall be performed within 24 hours of bolt tensioning to prevent possible loss of lubrication or corrosion influence on tensioning torque.

The inspection torque wrench shall be calibrated as follows: Three (3) bolts of the same grade, size, and condition as those under inspection shall be placed individually in a device calibrated to measure bolt tension. This calibration operation shall be done at least once each inspection day. There shall be a washer under the part turned in torquing each bolt. In the calibrated device, each bolt shall be tightened by any convenient means to the specified tension. The inspection wrench shall then be applied to the tensioned bolt to determine the torque required to turn the nut or head five degrees (5°) in the tightening direction. The average of the torque required for all three (3) bolts shall be defined as the job-inspection torque.

Twenty-five percent (25%), but a minimum of two (2), of the tensioned bolts shall be selected by the Engineer for inspection in each connection. (The Engineer may reduce the number of bolts tested at a connection to ten percent (10%) based on the Contractor's past performance and splice location.) The job-inspection torque shall then be applied to each selected assembly with the inspection torque wrench turned in

the tightening direction. If all inspected bolt heads or nuts do not turn, the bolts in the connection shall be considered to be properly tensioned. If the torque turns one or more bolt heads or nuts, the job-inspection torque shall then be applied to **all** bolts in the connection or to the satisfaction of the Engineer. Any bolt whose head or nut turns shall be re-tensioned and re-inspected. The Contractor may, however, re-tension all the bolts in the connection with the inspection torque wrench and resubmit it for inspection, so long as the bolts are not over-tensioned or damaged by this action.

(g) Field Corrections and Misfits: Reaming of bolt holes during erection shall be permitted only with approval of the Engineer. No excessive forces shall be applied to any member to provide for proper alignment of the bolt holes.

The correction of minor misfits involving minor amounts of reaming, cutting, grinding and chipping shall be considered a legitimate part of the erection. However, any error in the shop fabrication or deformation resulting from handling and transportation may be cause for rejection. The Contractor shall be responsible for all misfits, errors and damage and shall make the necessary corrections and replacements.

Table A (English)
Minimum Bolt Tension in kips*

Bolt Size (Inches)	ASTM A 325	ASTM A 490
5/8	19	24
3/4	28	35
7/8	39	49
1	51	64
1 1/8	56	80
1 1/4	71	102
1 3/8	85	121
1 1/2	103	148

*Equal to 70% of specified minimum tensile strength of bolts (as specified in ASTM Specifications for tests of full-size A 325 and A 490 bolts with UNC threads, loaded in axial tension) rounded to the nearest kip.

TABLE A (Metric)
Minimum Bolt Tension in Kilonewtons*

Bolt Size	ASTM A 325M	ASTM A 490M
M16	91	114
M20	142	179
M22	176	221
M24	205	257
M27	267	334
M30	326	408
M36	475	595

*Equal to 70% of specified minimum tensile strength of bolts (as specified in ASTM Specifications for tests of full-size A 325M and A 490M bolts with metric coarse threads series ANSI B1.13M, loaded in axial tension) rounded to the nearest kilonewton.

TABLE B (English and Metric)
Nut Rotation from the Snug Condition
Geometry^{a,b,c} of Outer Faces of Bolted Parts

Bolt Length (measured from underside of head to end of bolt)	Both Faces Normal to Bolt Axis	One Face Normal to Bolt Axis and Other Face Sloped Not More Than 1:20, Bevel Washer Not Used	Both Faces Sloped Not More Than 1:20 From Normal to Bolt Axis, Bevel Washer Not Used
Up to and including 4 diameters	1/3 turn	1/2 turn	2/3 turn
Over 4 diameters but not exceeding 8 diameters	1/2 turn	2/3 turn	5/6 turn
Over 8 diameters but not exceeding 12 diameters	2/3 turn	5/6 turn	1 turn

- (a) Nut rotation, as used in Table B, shall be taken as relative to the bolt, regardless of the element (nut or bolt) being turned. For bolts installed by 1/2 turn and less, the tolerance should be plus or minus 30 degrees; for bolts installed by 2/3 turn and more, the tolerance should be plus or minus 45 degrees.

To determine the nut rotation for installation and inspection of the fasteners, the nut and the end of the bolt or the head of the bolt and the adjacent steel shall be match marked.

- (b) The values, given in Table B, shall be applicable only to connections in which all material within grip of the bolt is steel.
- (c) No research work has been performed by the Research Council on Riveted and Bolted Structural Joints to establish the turn-of-nut procedure when bolt lengths exceed 12 diameters. For situations in which the bolt length, measured from the underside of the head to the end of the bolt, exceeds 12 diameters, the required rotation shall be determined by actual tests in a suitable tension device simulating the actual conditions.

TABLE C (English)

Bolt Dia. (in.)	Verification Tension		Maximum Verification Refusals		DTI Spaces		Minimum Installation Refusals	
	A325	A490	325	490	325	490	325	490
5/8	20	25	1	2	4	5	2	3
¾	29	37	2	2	5	6	3	3
7/8	41	51	2	2	5	6	3	3
1	54	67	2	3	6	7	3	4
1 1/8	59	84	2	3	6	7	3	4
1¼	75	107	3	3	7	8	4	4
1 3/8	89	127	3	3	7	8	4	4
1½	108	155	3	4	8	9	4	5

TABLE C (Metric)

Bolt Dia. (in.)	Verification Tension		Maximum Verification Refusals		DTI Spaces		Minimum Installation Refusals	
	A325	A490	Type 8.8	Type 10.9	Type 8.8	Type 10.9	Type 8.8	Type 10.9
M16	96	120	1	1	4	4	2	2
M20	149	188	2	2	5	6	3	3
M22	185	232	2	2	5	6	3	3
M24	215	270	2	2	5	6	3	3
M27	280	351	2	3	6	7	3	4
M30	342	428	3	3	7	8	4	4
M36	499	625	3	4	8	9	4	5

6.03.04—Method of Measurement: Payment under this item will be at the Contract lump sum price per each complete bridge structure or shall be based on the net weight (mass) of metal in the fabricated structure, whichever method appears on the bid proposal form.

When payment is on a lump sum basis, the work, including anchor bolts, steel bearings and plates will not be measured for payment. Bearing plates welded to the girder are included in the price of the structural steel and bearing plates bonded to the bearings are included in the price of the bearing.

When payment is based on the net weight (mass) of metal in the fabricated structure, it shall be computed as described below.

The weight (mass) of the metal works to be paid for under the item of structural steel shall be computed on the basis of the net finished dimensions of the parts as shown on the shop drawings, deducting for copes, cuts, clips and all open holes, except bolt holes, and on the following basis:

1. The weights (masses) of rolled shapes shall be computed on the basis of their nominal weights (masses) per foot (meter), as shown in the shop drawings or listed in handbooks.

The weight (mass) of plates shall be computed on the basis of the nominal weight (mass) for their width and thickness as shown on the shop drawings.

2. The weight (mass) of temporary erection bolts, shop and field paint, galvanization, boxes, crates and other containers used for shipping, and materials used for supporting members during transportation and erection, shall not be included.

3. The weight (mass) of all high strength bolts, nuts, and washers shall be included on the basis of the following weights (masses):

Weight per 100 pieces			
English units		Metric units	
Nominal diameter of H.S. bolt (inch)	Bolthead, nut, 1 washer and stick through (lbs)	Nominal diameter of H.S. bolt (mm)	Bolthead, nut, 1 washer and stick through (kg)
1/2	22	16	17
5/8	33	20	26
3/4	55	22	39
7/8	84	24	50
1	120	27	60
1 1/8	169	30	73
1 1/4	216	36	122

4. The weight (mass) of weld metal shall be computed on the basis of the theoretical volume from plan dimensions of the welds.

Size of fillet in Inches (mm)	Weight of weld in pounds per foot (kg per meter)
3/16 (5)	0.08 (0.119)
1/4 (6)	0.14 (0.208)
5/16 (8)	0.22 (0.327)
3/8 (9.5)	0.30 (0.446)
1/2 (13)	0.55 (0.818)
5/8 (16)	0.80 (1.190)
3/4 (19)	1.10 (1.636)
7/8 (22)	1.50 (2.231)
1 (25)	2.00 (2.974)

5. The weight (mass) of steel shims, filler plates and anchor bolts shall be measured for payment.

6.03.05—Basis of Payment: The structural steel, incorporated in the completed and accepted structure, will be paid for at the Contract lump sum price for "Structural Steel (Site No.)," or at the Contract unit price per hundredweight (kilogram) for "Structural Steel," whichever is indicated in the Contract.

Payment for either method shall be for structural steel, complete in place, which price shall include quality control, furnishing, fabricating, transporting, storage and handling, erecting, welding, surface preparation and all materials including fastener assemblies, steel bearing assemblies and anchor bolts, equipment, tools and labor incidental thereto.

The cost of the raw material is included in the lump sum payment for "Structural Steel (Site No.)." All remaining work including, but not limited to, preparation of shop drawings, fabricating, transporting, storage and handling, erecting, surface preparation and all materials, equipment, tools and labor incidental thereto, will be paid for under "Structural Steel (Site No.)."

No direct payment will be made for setting anchor bolts, preparing bearing areas, furnishing and placing materials under bearings. No direct payment will be made for non destructive testing as shown on the plans.

<u>Pay Item</u>	<u>Pay Unit</u>
Structural Steel (Site No.)	l.s. (l.s.)
Structural Steel	cwt. (kg)

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 6.12
CONCRETE CYLINDER CURING BOX**

Delete the entire section and replace with it the following:

6.12.01 –Description: This item shall consist of furnishing a box for curing concrete test cylinders. The box shall be commercially available and manufactured specifically for curing concrete test cylinders. The box will remain the property of the Contractor at the conclusion of the project. The box shall be delivered to a location on the project as directed by the Engineer.

6.12.02 – Materials: A catalog cut listing detailed specifications of the box and operating instructions from the manufacturer must be submitted to the Engineer. The box and its components shall be constructed of non-corroding materials and shall be capable of storing a minimum of 18 test cylinders, 6" X 12" (152 mm X 305 mm) stored vertically with the lid closed. The lid must be watertight when closed and hinged in the back with security latches on the front that can be padlocked. The box must be capable of holding water to a maximum level of one inch above test cylinders placed in the box vertically. A drain hole must be provided in a wall of the box to allow manual drainage of the water that exceeds this level. A drain hole must also be provided at the bottom of the box so that it can be manually emptied. The temperature of the water must be controlled by heating and cooling device capable of maintaining the temperature of the water within a range of 60 to 80° F, +/- 2 °F (15.5 to 26.7 °C, +/- 1 °C) within an outside ambient air temperature range of -10 to 120 ° F (-23.3 to 49 °C). The heating and cooling device must be positioned to allow free circulation of air and water around the cylinders and be rated at 120 volts and 15 amps. A rack must be provided within the box to support the cylinders above the pool of temperature controlled water. The device must be thermostatically controlled with a digital readout that is capable of displaying the high/low water temperature within the box since the last reading was taken.

6.12.03 - Construction Methods: The Contractor shall maintain the curing box in working order and shall provide all necessary electrical service and water so that the curing box can be used properly during the entire course of the project. Any curing box that is not operating properly, as determined by the Engineer, shall be replaced within 24 hours by the Contractor at no expense to the State. The Engineer reserves the right to prohibit placement of fresh concrete on the project until a curing box acceptable to the Engineer is operational on the project site.

6.12.04 - Method of Measurement: The furnishing of the concrete test cylinder curing box will be measured for payment by the number of boxes delivered by the Contractor and accepted by the Engineer.

6.12.05 – Basis of Payment: This item will be paid for at the contract unit price each for “Concrete Cylinder Curing Box” ordered and accepted on the project, which price shall include all submittals, material, tools, equipment, and labor incidental thereto. The price shall also include all maintenance and operating costs related to the curing box for the duration of the project.

Pay Item	Pay Unit
Concrete Cylinder Curing Box	ea. (ea.)

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 6.51
CULVERTS**

6.51.02 – Materials:

Delete the 2nd paragraph, “Pipes of the type indicated ... of Article M.02.01.” and insert the following paragraph:

“Pipes of the type indicated on the plans and joint sealant shall conform to the requirements of Article M.08.01. Bedding material shall conform to the requirements of Article M.08.03. Granular fill shall conform to the requirements of Article M.02.01.”

6.51.03 – Construction Methods:

In the 8th paragraph replace “gravel fill” with “granular fill”.

Delete the 13th paragraph, “Bituminous fiber and ... as the pipe.”

6.51.04 – Methods of Measurement:

In the 7th paragraph, replace “Gravel Fill” with “Granular Fill”.

6.51.05 – Basis of Payment:

In the 8th paragraph, replace “Gravel Fill” with “Granular Fill”.

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 7.01
DRILLED SHAFTS**

Add the following section:

**SECTION 7.01
DRILLED SHAFTS**

- 7.01.01 – Description**
- 7.01.02 – Materials**
- 7.01.03 – Construction Methods**
- 7.01.04 – Method of Measurement**
- 7.01.05 – Basis of Payment**

7.01.01 - Description: This work shall consist of all labor, materials, equipment and services necessary to complete the Drilled Shaft installation in accordance with the Contract. Drilled shafts shall be made primarily of reinforced or unreinforced concrete.

7.01.02 - Materials: Drilled Shafts shall be made of the following materials:

1. Portland Cement Concrete: Concrete used in the construction of the shaft shall conform to the plans, Section M.03, and to the following:

- (a) The concrete shall have a minimum initial slump of 8 in (200 mm).
- (b) The concrete mix shall maintain a slump of no less than 4 in (100 mm) for a minimum of three (3) hours beyond the expected time for placement of concrete and removal of temporary casing (if used), as indicated by trial mixes and physical tests of slump loss. The trial mix and physical tests (slump loss tests) shall be conducted using concrete mix and ambient air temperatures anticipated during concrete placement.
- (c) All admixtures, if approved for use, shall be adjusted for the conditions encountered on the job so as to conform to the slump loss requirements within this specification and must not adversely affect the timing of, taking of or interpretation of any Nondestructive Testing that may be called for in the Contract.
- (d) Coarse aggregate shall conform to Article M.01.01, No. 8 Gradation.

2. Reinforcing Steel: Reinforcing steel used in construction of the shaft shall conform to Article M.06.01.

3. Access Tubes: Access tubes for cross-hole acoustic logging shall be made of Schedule 40 steel pipe conforming to ASTM A 53, Grade A or B, Type E, F, or S. The tubes' inside diameter shall be at least 1.5 in (38 mm). All access tubes, including all pipe joints, shall

have a round, regular inside surface free of defects and obstructions, in order to permit the free, unobstructed passage of probes to the bottoms of the tubes. The access tubes shall be watertight, free from corrosion and free of deleterious material on the outside that could prevent bonding with the concrete. All access tubes shall be fitted with watertight caps on the bottom and top.

4. **Grout:** Grout used for filling Access Tubes shall meet the requirements of Article M.03.05. The grout shall have strength properties equivalent to or better than those of the drilled shaft concrete.
5. **Permanent Casing:** Steel casing shall conform to the requirements of ASTM A36 or A252 Grade 2 unless otherwise specified on the plans. Casings shall be smooth, clean, watertight, and of ample strength to withstand handling, installation, and the pressure from surrounding concrete and earth materials. The outside diameter of any casing shall not be less than the specified diameter of the shaft.

7.01.03 - Construction Methods:

1. **Qualifications of Drilled Shaft Contractor and Submittals:** The Contractor performing the work described in this specification shall have been installing drilled shafts of both diameter and length similar to those shown on the plans for a minimum of three (3) years prior to the bid date for this Project. The Contractor shall submit a list of projects that it has performed in said three (3) years that met these criteria. The list of projects shall contain names and phone numbers of owner's representatives who can verify the Contractors' participation on those projects, and that they met said criteria.

As early as possible, and no later than thirty (30) days prior to constructing drilled shafts, the Contractor shall submit to the Engineer an Installation Plan for the shafts. This Plan shall provide the following information:

- (a) A list identifying the intended on-Site supervisor(s) and drill operator(s), for approval by the Engineer. The on-Site supervisor(s) shall have a minimum of two (2) years' experience supervising the construction of drilled shafts of a diameter and length similar to those shown on the plans. The drill operator(s) shall have a minimum of one (1) years' experience drilling for the construction of drilled shafts of a diameter and length similar to those shown on the plans. The list shall contain a summary of each individual's experience.

Should the Contractor elect to change any of these intended personnel during construction of the shafts, this same approval process will need to be completed for the new personnel prior to their starting work on the Project. The Contractor shall not be compensated for any delays resulting from such changing of personnel.

- (b) List of proposed equipment to be used, including cranes, drills, augers, bailing buckets, final cleaning equipment, desanding equipment, slurry pumps, core sampling equipment, tremies or concrete pumps, casing and any other equipment required for construction of the shafts.

- (c) Details of overall construction operation sequence and the sequence of shaft

construction in bents or groups.

- (d) Details of the Contractor's intended shaft excavation methods.
- (e) When the use of slurry is anticipated, details of the mix design and its suitability for the subsurface conditions at the Site, mixing and storage methods, maintenance methods, and disposal procedures.
- (f) Details of methods for cleaning the shaft excavation.
- (g) Details of reinforcement placement, including support and centralization methods.
- (h) Details of concrete mix design and test results of both a trial mix and a slump loss test. The tests shall be conducted by an approved testing laboratory, using approved methods to demonstrate that the concrete meets slump loss requirements.
- (i) Details of concrete placement, including proposed operational procedures for free fall, tremie or pumping methods, proposed concreting log form and computations for time duration of shaft pour estimates.
- (j) Details of casing installation and removal methods. If welding of casing is proposed, submit the welding procedure. All welding shall be done in accordance with the current AWS Structural Welding Code.
- (k) Details of methods for removal of obstructions. Obstructions for which the Contractor shall provide details of methods for removal include, but are not necessarily limited to, removal of boulders, concrete, riprap, steel, timber or miscellaneous debris.
- (l) Details for any monitoring plan as called for in the Contract.

The Engineer will evaluate the drilled shaft Installation Plan for conformance with the Contract and will then notify the Contractor of any additional information required or changes necessary in order to meet Contract requirements. All procedural approvals given by the Engineer shall be subject to trial in the field and shall not relieve the Contractor of the responsibility to satisfactorily complete Project work as detailed in the plans and specifications. The Contractor shall not commence construction of drilled shafts until the Engineer has approved the Installation Plan.

If integrity or load testing of the drilled shafts is called for by the Contract or the Site conditions, this submittal shall be developed in coordination with and submitted concurrently with working drawing submittals, as required in the testing specifications.

All submittals shall comply with the working drawing submittal requirements outlined in Article 1.05.02.

- 2. Trial Drilled Shaft Installation and Load Testing:** When called for in the Contract, the Contractor shall demonstrate the adequacy of the proposed methods, techniques and equipment by successfully constructing a trial drilled shaft in accordance with these

specifications. This trial drilled shaft shall be positioned away from production shafts, in the location shown on the plans or as directed by the Engineer. The trial shaft shall be drilled to the maximum depth shown in the plans. Failure by the Contractor to demonstrate to the Engineer the adequacy of methods and equipment shall be reason for the Engineer to require alterations of the Contractor's equipment or methods in order to prevent results unacceptable under the Contract or to the Engineer. Any additional trial drilled shaft required to demonstrate the adequacy of altered methods or construction equipment shall be at the Contractor's expense. Once the Engineer approves construction of production shafts, no changes will be permitted in the personnel, materials, methods or equipment used by the Contractor in constructing the satisfactory trial drilled shaft, unless the Contractor obtains the Engineer's written approval to do so.

Unless otherwise shown in the Contract, the trial drilled shaft shall have reinforcing bars, access tubes and concrete placed using the same materials and methods of construction to be used during construction of the production drilled shafts. The trial drilled shaft shall be cut off 2 ft (0.6 m) below finished grade and left in place. The disturbed area(s) at the site(s) of the trial drilled shaft(s) shall be restored as nearly as practical to original conditions.

Should the plans call for load testing of the trial drilled shaft, all necessary loading apparatus, instrumentation and other equipment required for performing the load test will be specified and paid for under a separate item.

All trial drilled shaft(s) and load test(s) must be completed and accepted by the Engineer prior to construction of any production drilled shafts. In the event that there is more than one trial drilled shaft and load test, the Contractor may begin construction of some of the production drilled shafts, in whatever way that the Engineer requires or approves.

- 3. Protection of Existing Structures:** The Contractor shall control drilled shaft operations in a way that will prevent damage to existing structures or utilities, in accordance with Articles 1.07.09 and 1.07.13. Preventive measures shall include, but are not limited to: selecting construction methods and procedures to prevent caving of the shaft excavation, and that will include monitoring and controlling the vibrations from construction activities such as the driving of casing or sheeting, drilling of the shaft, or from any blasting that the Contract or the Engineer may have permitted.

If monitoring is called for in the Contract, a preconstruction survey of existing facilities shall be performed to establish baseline data, including ambient vibration levels and existing structural defects. In general, monumented survey points shall be established on structures which are located within a distance of either ten (10) shaft diameters or the estimated shaft depth, whichever is greater. These points shall be monitored by the Contractor for vertical and lateral movement in an approved manner to the accuracy required by the Engineer.

When deformations exceed the predetermined amount included in the plans, the Contractor shall immediately stop work and, if directed by the Engineer to do so, backfill the excavated hole. The Contractor shall be responsible for selecting and using equipment and procedures that keep deformations of existing structures within levels specified by the Contract or Engineer.

When vibrations are to be monitored, the Contractor must engage the services of a professional vibrations consultant to monitor and record vibration levels during drilled shaft construction. Unless the Engineer states otherwise, vibration monitoring equipment must be capable of detecting velocities of 0.1 in/sec (2.5 mm/sec) or less. When vibration levels exceed tolerable levels established by the Contract or Engineer, the Contractor shall immediately stop the work causing the vibrations and take whatever measures are necessary to reduce vibration levels to below tolerable levels. All costs related to vibration monitoring required in the Contract shall be included in the bid price for the Drilled Shaft item.

- 4. Construction Sequence:** Excavation to footing elevation shall be completed before shaft construction begins unless otherwise noted in the Contract or approved by the Engineer. Any disturbance at or below the footing area caused by shaft installation shall be repaired by the Contractor prior to the footing construction.

When drilled shafts are to be installed in conjunction with embankment placement, the Contractor shall construct drilled shafts after the placement of fills, unless shown otherwise in the Contract or approved by the Engineer.

Drilled shafts, constructed prior to the completion of the fills, shall not be capped until the fills have been placed as near to final grade as possible, leaving only the workroom necessary for construction of the caps.

- 5. Exploration Test Borings:** As soon as possible, the Contractor shall take soil samples or rock cores, where shown on the plans or as directed by the Engineer, in order to determine the character of the material directly below the completed shaft excavation. The soil samples shall be extracted with a split spoon sampler or undisturbed sample tube. The rock cores shall be cut with an approved triple tube core barrel to a minimum of 10 ft (3 m) below the bottom of the drilled shaft excavation before the excavation is made. The Engineer may require the depth of coring be extended up to a total depth of 20 ft (6 m). Rock core and standard penetration test samples shall be measured, visually identified and described in the Contractor's log. The samples shall be placed in suitable containers, identified by shaft location, elevation, and Project number and shall be delivered with the Contractor's field log to the Engineer within twenty-four (24) hours after each boring exploration is completed. The Engineer will inspect the samples and log in order to determine the final depth of required excavation based on evaluation of the material's suitability. The Contractor shall not start shaft drilling or construction of the shafts until the Engineer has determined the final depth of required excavation. Two (2) copies of the Contractor's final typed log shall be furnished to the Engineer within seven (7) calendar days after completion of the borings. The logs shall contain specific information about the drilling equipment and tools used and the rate of hole advancement, as well as descriptions of soil, rock, obstructions, and water encountered. The Contractor shall supply a suitable, secure location on the Site for storage of all soil and rock samples. At no time shall the soil or rock core samples be taken off the Site without the Engineer's permission to do so.

- 6. General Methods and Equipment:** The Contractor shall perform the excavations required for shafts through whatever materials are encountered, to the dimensions and elevations shown in the plans or otherwise required by the Contract. The Contractor's methods and equipment shall be suitable for the intended purpose and materials encountered. The

permanent casing method shall be used only at locations shown on the plans or authorized by the Engineer in writing. Blasting shall be permitted only if specifically authorized on the plans or in writing by the Engineer.

- 7. Uncased Construction Method:** This method consists of using water or slurry (mineral or polymer) to maintain stability of the borehole perimeter while advancing the excavation to final depth, placing the reinforcing cage, and concreting the shaft. Where drilled shafts are located in open water areas, exterior casings shall be extended from above the anticipated high water elevation into the ground in order to protect the shaft concrete from water action during placement and curing of the concrete. The exterior casing shall be installed in a manner that will produce a positive seal at the bottom of the casing, so that no piping of water or other materials occurs into or from the shaft excavation.
- 8. Casing Construction Method:** The casing method may be used either where shown on the plans or at sites where uncased construction methods are inadequate to prevent hole caving or excessive deformation of the hole. In using this method, the casing may either be placed in a predrilled hole or advanced through the ground by twisting, driving or vibration before being cleaned out.
- 9. Excavation and Drilling Equipment:** The Contractor's excavation and drilling equipment shall have adequate capacity, including power, torque and down-thrust to make it possible to excavate a hole of the maximum diameter and to a depth of twenty percent (20%) beyond the depths shown on the plans.

The excavation and overreaming tools shall be of adequate design, size and strength to perform the work shown in the plans or described herein. When the material encountered cannot be drilled using conventional earth augers with soil or rock teeth, drill buckets, grooving tools, or underreaming tools, the Contractor shall provide special drilling equipment, including but not limited to: rock core barrels, rock tools, air tools, blasting materials, or other equipment as necessary to enable construction of the shaft excavation to the size and depth required. Excavation by blasting may not be performed without the prior written approval of same by the Engineer.

- 10. Excavation:** Shaft excavations shall be made at locations and to the top of shaft elevations, estimated bottom of shaft elevations, shaft geometry and dimensions shown in the Contract. If material encountered during excavation is unsuitable for these purposes or differs from that anticipated in the design of the drilled shaft, the Contractor shall extend drilled shaft tip (base) elevations as and when the Engineer directs it to do so.

The Contractor shall maintain a construction method log during shaft excavation. The log shall contain information such as the description and approximate top and bottom elevation of each soil or rock material encountered, of seepage or ground water, and any other relevant information or observations, including a description of the tools and drill rigs used and any changes necessitated by changing ground conditions.

The Contractor shall dispose of any excavated materials removed from shaft excavations in accordance with the applicable Contract requirements for disposal of excavated materials, including those in Section 1.10.

The Contractor shall not permit workers to enter the shaft excavation for any reason unless (1) a suitable casing has been installed and the water level has been lowered and stabilized below the level to be occupied, and (2) adequate safety equipment and procedures have been provided to workers entering the excavation. Any placement of workers within the shaft excavation shall be in conformance with OSHA regulations and industry standards.

- 11. Drilled Shaft Earth Excavation:** Drilled shaft earth excavation is (1) excavation accomplished with conventional tools such as augers and drilling buckets attached to drilling equipment of the size, power, torque, and down-thrust (crowd) proposed by the Contractor in a construction procedure approved by the Engineer, or (2) successful construction of a trial drilled shaft. Earth excavation may include, but will not necessarily be limited to, excavation of clay, silt, sand, gravel, cobbles, boulders, weathered rock, and miscellaneous fill.
- 12. Drilled Shaft Rock Excavation:** Drilled shaft rock excavation is (1) excavation of competent rock, accomplished with conventional rock drilling tools, such as core barrels attached to drilling equipment of the size, power, torque, and down-thrust (crowd) as proposed by the Contractor in a construction procedure approved by the Engineer or (2) successful construction of a trial drilled shaft. Top of competent rock is as shown on the Contract drawings.
- 13. Obstructions:** When obstructions are encountered, the Contractor shall notify the Engineer of them immediately. Obstructions are defined as impenetrable objects that
- (a) cannot be removed or excavated using conventional augers fitted with soil or rock teeth, underreaming tools, or drilling buckets; or
 - (b) cause a significant decrease in the rate of excavation advancement, relative to the rate of advancement for the rest of the shaft excavation within the particular strata where the obstruction is located that had been achieved using the techniques and equipment that had previously been used successfully to excavate the shaft.

The Engineer will be the sole judge of the significance of any reduced rate of shaft advancement and of the classification of obstruction excavation. The Engineer will be present at the site of the obstruction in order to evaluate obstructions, to authorize measures for dealing with them, and to approve the designation each obstruction. Sloping bedrock or bedrock that is higher than anticipated by the plans shall not be considered as requiring obstruction excavation. Shallow obstructions are obstructions located within 5 ft (1.5 m) of the top level of the shaft. Shallow obstructions at shaft locations shall be removed at the Contractor's expense.

The Contractor shall remove all subsurface obstructions at drilled shaft locations. Such obstructions may include man-made materials, such as concrete foundations, and natural materials, such as boulders. Subsurface obstruction removal special procedures/tools may include, but are not limited to, chisels, boulder breakers, core barrels, down-the-hole hammers, air tools, hand excavation, temporary casing, and increases of the hole diameter. Blasting shall not be permitted unless specifically approved in advance in writing by the Engineer.

- 14. Lost Tools:** Drilling tools lost in the excavation shall not be considered obstructions and shall be promptly removed by the Contractor without compensation. All costs due to lost tool removal shall be borne by the Contractor including, but not limited to, costs associated with the repair of hole degradation due to removal operations or due to the hole's remaining open for an excessively long time.
- 15. Casing:** Casings shall be steel, smooth, clean, watertight, and of ample strength to withstand both handling and installation and the pressure of both concrete and the surrounding earth materials. The outside diameter of casings shall not be less than the specified diameter of the shaft, and the outside diameter of any excavation made below the casing shall not be less than the specified diameter of the shaft. No extra compensation will be paid for concrete required to fill an oversized casing or oversized excavation. All casings, except permanent casings, shall be removed from shaft excavations. Any length of permanent casing installed below the shaft cutoff elevation shall remain in place.

When the shaft extends above ground or through a body of water, the portion exposed above ground or through the water may be formed with removable casing, except when permanent casing is specified. Removable casing shall be stripped from the shaft in a manner that will not damage the concrete. Casings may be removed when the concrete has attained sufficient strength, provided: curing of the concrete is continued for a seventy-two (72) hour period; the shaft concrete is not exposed to salt water or moving water for seven (7) days; and the concrete reaches a compressive strength of at least 2500 psi (17,235 kPa) as determined from concrete cylinder breaks.

- 16. Temporary Casing:** All subsurface casing shall be considered temporary unless specifically shown as permanent casing in the Contract. The Contractor shall be required to remove temporary casing before or immediately after completion of concreting the drilled shaft. Casing shall never be pulled after the concrete begins to set, due to probable entrapment of drilling fluid in the shaft concrete and probable separation of the concrete within the shaft.

If the Contractor elects to remove a casing and substitute a longer or larger-diameter casing through caving soils, the excavation shall either be stabilized with slurry or backfilled before the new casing is installed. Other methods approved by the Engineer may be used to control the stability of the excavation and protect the integrity of foundation materials.

Before the casing is withdrawn, the level of fresh concrete in the casing shall be a minimum of 5 ft (1.5 m) above either the hydrostatic water level in the formation or the level of drilling fluid in the annular space behind the casing, whichever is higher. As the casing is withdrawn, care shall be exercised to maintain an adequate level of concrete within the casing, so that fluid trapped behind the casing is displaced upward and discharged at the ground surface without contaminating or displacing the shaft concrete.

Temporary casings that become bound or fouled during shaft construction and cannot practicably be removed shall constitute a defect in the drilled shaft. The Contractor shall be responsible to improve such defective shafts to the satisfaction of the Engineer. Improvement may consist of, but not be limited to, removing the shaft concrete and extending the shaft deeper, in order to compensate for loss of frictional capacity in the cased zone; providing straddle shafts to compensate for capacity loss; grouting around the

exterior of the shaft; or providing a replacement shaft. All corrective measures, including redesign of footings caused by defective shafts, shall be done to the satisfaction of the Engineer by the Contractor without either compensation or an extension of Contract time of the Project. In addition, no compensation will be paid for casing remaining in place.

- 17. Permanent Casing:** Permanent casing shall be used where specified by the Contract. The casing shall be continuous between top and bottom elevations as shown in the plans. After installation is complete, the permanent casing shall be cut off at the prescribed elevation.

In cases in which special temporary casings are shown on the plans or authorized in writing by the Engineer to be used in conjunction with permanent casing, the Contractor shall maintain both alignment of the temporary casing with the permanent casing and a positive, watertight seal between the two casings during excavation and concreting operations.

Permanent casing shall maintain close contact with the surrounding earth after installation. Use of an oversized hole or temporary casing outside the permanent casing beneath the ground surface will not be allowed without the advance written permission of the Engineer to do so. Should an oversized hole or temporary casing outside the permanent casing beneath the ground surface be allowed by the Engineer, grouting of the exterior annular space shall be provided by the Contractor in order to create close contact between the casing and the surrounding ground. The grouting shall extend from the bottom of the annular space to an elevation determined by the Engineer. No compensation will be paid to the Contractor for grouting of the exterior annular space.

- 18. Slurry:** Mineral or polymer slurries shall be employed when slurry is used in the drilling process, unless other drilling fluids are approved in writing by the Engineer. Mineral slurry shall have both a mineral grain size that will remain in suspension and sufficient viscosity and gel characteristics to allow it to transport excavated material to a suitable screening system. The percentage and specific gravity of the material used to make the mineral suspension shall be sufficient to maintain the stability of the excavation and to allow proper concrete placement.

During construction, the level of the slurry shall be maintained at a height sufficient to prevent caving of the hole. The slurry head shall remain above the piezometric head of the groundwater. This includes initial drilling of the borehole down to the piezometric level. Slurry shall be introduced when the depth of the borehole is still above the piezometric level, not after the inflow of water can be detected and sloughing has begun. In the event of a sudden significant loss of slurry to the hole, the construction of that foundation shall be stopped until either a method to stop slurry loss or an alternate construction procedure has been approved by the Engineer.

Mineral slurry shall be premixed thoroughly with clean fresh water and adequate time (as prescribed by the mineral manufacturer) shall be allotted for hydration prior to introduction into the shaft excavation. Slurry tanks of adequate capacity shall be required for slurry circulation, storage, and treatment. No excavated slurry pits will be allowed in lieu of slurry tanks without the written consent of the Engineer to the substitution. Desanding equipment shall be provided by the Contractor as necessary to keep slurry sand content at less than

four percent (4%) by volume at any point in the borehole at the time the slurry is introduced, including situations in which temporary casing will be used. The Contractor shall take all steps necessary to prevent the slurry from "setting up" in the shaft. Such methods may include, but are not limited to: agitation, circulation and adjusting the properties of the slurry. The Contractor shall dispose of all slurry in suitable off-Site areas. Disposal of the slurry shall also comply with Section 1.10.

Control tests using suitable apparatus shall be carried out on the mineral slurry by the Contractor in order to determine density, viscosity and pH. An acceptable range of values for mineral slurry physical properties is shown in Table 7.01-1:

TABLE 7.01-1, MINERAL SLURRY PROPERTIES
(Sodium Bentonite or Attapulgite in Fresh Water)

Property	Acceptable Range of Values		
	At Time of Slurry Introduction	In Hole at Time of Concreting	Test Method
Density - pcf (kN/m ²)	64.3* - 69.1* (10.1* - 10.8*)	64.3* - 75.0* (10.1* - 11.8*)	Density Balance
Viscosity - sec./quart (sec./liter)	28 - 45 (26 - 43)	28 - 45 (26 - 43)	Marsh Funnel
pH	8 - 11	8 - 11	pH paper, pH meter
<p>* Increase by 2 pcf (0.3 kN/m²) in salt water</p> <p>Notes:</p> <p>(a) Tests shall be performed when the slurry temperature is above 40° F (4.5° C).</p> <p>(b) If desanding is required, sand content shall not exceed 4% (by volume) at any point in the borehole, as determined by the American Petroleum Institute sand content test when the slurry is introduced.</p>			

Tests to determine density, viscosity and pH value shall be performed during the shaft excavation to establish a consistent working pattern. A minimum of four (4) sets of tests shall be made during the first eight (8) hours of slurry use. When the tests show consistent results, the testing frequency may be decreased to one (1) set every four (4) hours of slurry use.

If the Contractor proposes to use polymer slurry, either natural or synthetic, use of the product must be approved in advance by the Engineer. Slurry properties at the time of mixing and at the time of concreting must comply with the manufacturer's written recommendations. Whatever product is used, the sand content at the base of the drilled shaft excavation shall not exceed one percent (1%) when measured by Method API 13B-1, Section 5, immediately prior to concreting.

If the Contractor proposes to use blended mineral-polymer slurry, the Contractor shall submit to the Engineer a detailed report specific to the Project, prepared and signed by a qualified slurry consultant, describing the proposed slurry materials, the mix proportions, mixing methods and quality control methods.

If polymer slurry, or blended mineral-polymer slurry, is proposed, the Contractor's slurry management plan shall include detailed provisions for controlling the quality of the slurry, including tests to be performed, the frequency of those tests, the test methods, and any maximum or minimum property requirements that must be met in order to ensure that the slurry meets its intended functions in the subsurface conditions at the Project site and with the construction methods to be used. The slurry management plan shall include a set of the slurry manufacturer's written recommendations and shall include the following tests, as a minimum: Density test (API 13B-1, Section 1), viscosity test (Marsh funnel and cup, API 13B-1, Section 2.2, or approved viscometer), pH test (pH meter, pH paper), and sand content test (API sand content kit, API 13B-1, Section 5).

If such a proposal is approved by the Engineer, the Contractor may use water as a drilling fluid. In that case, all of the provisions in Table 7.01-1 for mineral slurries must be met, except that the maximum density shall not exceed 70 pcf (11 kN/m²).

The Contractor shall ensure that a heavily-contaminated slurry suspension, which could impair the free flow of concrete, has not accumulated in the bottom of the shaft. Prior to placing concrete in any shaft excavation, the Contractor shall take slurry samples using a sampling tool approved by the Engineer. Slurry samples shall be extracted from the base of the shaft and at intervals not exceeding 10 ft (3 m) up the slurry column in the shaft, until two (2) consecutive samples produce acceptable values for density, viscosity, and pH.

When any slurry samples are found to be unacceptable, the Contractor shall take whatever action is necessary to bring the slurry within specification requirements. Concrete shall not be placed until the slurry in the hole is re-sampled and test results produce acceptable values.

Reports of all tests specified above, signed by an authorized representative of the Contractor, shall be furnished to the Engineer on completion of each drilled shaft.

During construction, the level of mineral or blended mineral-polymer slurry in the shaft excavation shall be maintained at a level not less than 4 ft (1.2 m) above the highest expected piezometric pressure head along the depth of the shaft, and the level of polymer slurry shall be maintained at a level not less than 6 ft (1.8 m) above the highest expected piezometric pressure head along the shaft. If at any time, in the opinion of the Engineer, the slurry construction method fails to produce the desired final results, the Contractor shall discontinue this method and propose an alternate method for approval by the Engineer.

Drilling tools shall contain vents to stabilize hydrostatic pressure above and below the tool during insertion and extraction. The rate of tool extraction shall not cause any noticeable turbulence in the slurry column in the borehole.

The Contractor shall arrange for the slurry manufacturer's technical representative to be present at the Site during Project startup, or throughout the entire Project if continual difficulty is expected, in order to ensure that the slurry is mixed and managed properly.

- 19. Excavation Inspection:** The Contractor shall check the dimensions and alignment of each shaft excavation. Final shaft depths shall be measured with a suitable weighted tape or other approved method after final cleaning. The Contractor shall provide equipment and

access to the Engineer for confirming dimension, alignment, and bottom cleanliness. Acceptable shaft cleanliness will be determined by the Engineer.

20. Construction Tolerances: The following construction tolerances apply to drilled shafts, unless otherwise stated in the Contract:

- (a) The center of the drilled shaft shall be within 3 in (76 mm) of plan position in the horizontal plane at the plan elevation for the top of the shaft.
- (b) The vertical alignment of a vertical shaft excavation shall not vary from the plan alignment by more than 1/4 in/ft (21 mm/m) of depth.
- (c) After the concrete is placed, the top of the reinforcing steel cage shall be no more than 6 in (150 mm) above and no more than 3 in (76 mm) below plan position.
- (d) All casing diameters shown on the plans refer to outside diameter ("OD") dimensions. The dimensions of casings are subject to American Petroleum Institute tolerances applicable to regular steel pipe. The Contractor may elect to provide a casing larger in diameter than shown in the plans, if the Engineer approves its doing so.
- (e) The top elevation of the shaft shall have a tolerance of plus 1 in (25 mm) or minus 3 in (76 mm) from the plan top-of-shaft elevation.
- (f) Excavation equipment and methods shall be designed so that the completed shaft excavation will have a planar bottom. The cutting edges of excavation equipment shall be normal to the vertical axis of the equipment within a tolerance of +/- 3/8 in/ft (+/- 3 mm/m) of diameter.

Drilled shaft excavations and completed shafts not constructed within the required tolerances are unacceptable. The Contractor shall be responsible for correcting all unacceptable shaft excavations and completed shafts to the satisfaction of the Engineer. Materials and work necessary, including engineering analysis and redesign, in order to complete corrections for out-of-tolerance drilled shaft excavations, shall be furnished without cost to the State or extension of Contract time.

21. Reinforcing Steel Cage Construction and Placement: The reinforcing steel cage, consisting of longitudinal bars, ties, cage stiffener bars, spacers, centralizers, and other necessary appurtenances, shall be completely assembled and placed as a unit immediately after the shaft excavation is inspected and accepted, and prior to concrete placement. Internal stiffeners shall be removed as the cage is placed in the borehole, so as not to interfere with the placement of concrete.

The reinforcing steel in the shaft shall be tied and supported so that the reinforcing steel will remain within allowable tolerances. Concrete spacers or other approved noncorrosive spacing devices shall be used at sufficient intervals near the bottom and at intervals not exceeding 10 ft (3 m) up the shaft, in order to ensure concentric spacing for the entire cage length. Spacers shall be constructed of approved material, equal in quality and durability to the concrete specified for the shaft. The spacers shall be of adequate dimension to ensure

a minimum 3 in (76 mm) annular space between the outside of the reinforcing cage and the side of the excavated hole. Approved cylindrical concrete feet (bottom supports) shall be provided to ensure that the bottom of the cage is maintained the proper distance above the base.

The elevation of the top of the steel cage shall be checked before and after the concrete is placed. If the upward displacement of the rebar cage exceeds 2 in (51 mm) or if the downward displacement exceeds 6 in per 20 ft (152 mm per 6 m) of shaft length, the drilled shaft will be considered defective. In such a case, corrections shall be made by the Contractor to the satisfaction of the Engineer. No additional shafts shall be constructed until the Contractor has modified the rebar cage support in a manner satisfactory to the Engineer.

22. Concrete Placement: Concrete placement shall be performed in accordance with the applicable portions of Section 6.01 and with the requirements herein dealing with concrete materials.

Concrete shall be placed as soon as possible after reinforcing steel placement and after the Engineer has accepted the cleanliness of the shaft. The Engineer may re-inspect the shaft for cleanliness should there be any delays between initial acceptance of shaft cleanliness and commencement of the concrete placement. If during such a delay the Engineer has determined that shaft cleanliness has deteriorated, the Engineer may require the Contractor to re-clean the shaft. The Contractor may be required to remove the rebar cage should it be necessary in order to achieve the required shaft cleanliness. The Contractor will not be compensated for any cost or loss of time due to the need to re-clean the shaft.

Concrete placement shall be continuous from the bottom to the top elevation of the shaft. Concrete placement shall continue after the shaft excavation is filled and good quality concrete is evident at the top of shaft. Concrete shall be placed by free fall, or through a tremie or concrete pump. Free fall placement will be permitted only in dry holes. Concrete placed by free fall shall fall directly to the base without contacting the rebar cage or hole sidewall. Drop chutes may be used to direct concrete to the base during free fall placement.

The Contractor shall maintain Concreting Logs during all concrete placement. The log shall include, but not be limited to, concreting curves plotting Depth-to-Top of Concrete vs. Volume of Concrete Placed (for both theoretical and actual volumes of concrete placed). The Contractor shall provide a copy of each log to the Engineer upon completion of each drilled shaft concrete placement. A sample of the proposed log to be used by the Contractor shall be submitted as part of the Installation Plan working drawing submittal.

23. Tremies: Tremies may be used for concrete placement in either wet or dry holes. Tremies used to place concrete shall consist of a tube of sufficient length, weight, and diameter to discharge concrete at the shaft base elevation. The tremie shall not contain aluminum parts that may come in contact with the concrete. The tremie's inside diameter shall be at least six (6) times the maximum size of aggregate used in the concrete mix, but shall not be less than 10 in (254 mm). The inside and outside surfaces of the tremie shall be clean and

smooth in order to permit flow of concrete and unimpeded withdrawal during concreting. The wall thickness of the tremie shall be adequate to prevent crimping or sharp bends, which would restrict concrete placement.

The tremie used for wet excavation concrete placement shall be watertight. Underwater or under-slurry placement shall not begin until the tremie is placed to the shaft base elevation, and the concrete shall be kept completely separated from the water or slurry prior to the time that it is discharged. Valves, bottom plates or plugs may be used for this purpose only if concrete discharge can begin within 1 tremie diameter of the base of the drilled shaft. Plugs shall either be removed from the excavation or be of a material approved by the Engineer that will not cause a defect in the shaft if not removed. The discharge end of the tremie shall be constructed to permit the free radial flow of concrete during placement operations. The tremie discharge end shall be immersed at least 5 ft (1.5 m) in concrete at all times after starting the flow of concrete. The flow of the concrete shall be continuous. The level of the concrete in the tremie shall be maintained above the level of slurry or water in the borehole at all times, in order to prevent water or slurry intrusion into the shaft concrete.

If at any time during the concrete placement, the tremie line orifice is removed from the fluid concrete column and it discharges concrete above the rising concrete level, the shaft will be considered defective. All costs of repair or replacement of defective shafts shall be the responsibility of the Contractor.

- 24. Pumped Concrete:** Concrete pumps and lines may be used for concrete placement in either wet or dry excavations. All pump lines shall have a minimum 4 in (102 mm) diameter and be constructed with watertight joints. Concrete placement shall not begin until the pump line discharge orifice is at the shaft base elevation.

For wet excavations, a plug or similar device shall be used to separate the concrete from the fluid in the hole until pumping begins. The plug shall either be removed from the excavation or be of a material approved by the Engineer that will not cause a defect in the shaft if not removed.

The discharge orifice shall remain at least 5 ft (1.5 m) below the surface of the fluid concrete. When lifting the pump line during concreting, the Contractor shall temporarily reduce the line pressure until the orifice has been repositioned at a higher level in the excavation.

If at any time during the concrete placement the pump line orifice is removed from the fluid concrete column and it discharges concrete above the rising concrete level, the shaft will be considered defective. All costs of repair or replacement of defective shafts shall be the responsibility of the Contractor.

- 25. Drop Chutes:** Drop chutes may be used to direct placement of free-fall concrete in excavations where the maximum depth of water does not exceed 3 in (76 mm). Free fall placement is not permitted in wet excavations. Drop chutes shall consist of a smooth tube of either one-piece construction or sections that can be added and removed. A drop chute can also be a hopper with a short tube to direct the flow of concrete. Concrete may be placed through either the hopper at the top of the tube or side openings as the drop chute

is retrieved during concrete placement. If concrete placement causes the shaft excavation to cave or slough, or if the concrete strikes the rebar cage or sidewall, the Contractor shall reduce the height of free fall or reduce the rate of concrete flow into the excavation, or both. If caving or sloughing of the borehole walls occurs during free-fall placement of concrete, the shaft will be considered defective. All costs of repair or replacement of defective shafts shall be the responsibility of the Contractor. If concrete placement cannot be satisfactorily accomplished by free fall, in the opinion of the Engineer, the Contractor shall use either tremie or pumping techniques to accomplish the concrete placement.

- 26. Access Tubes for Crosshole Acoustic Logging:** Access tubes for crosshole acoustic logging shall be placed on each reinforcing cage designated in the Contract in the position and at the frequency shown on the plans. Access tubes must be firmly secured to the cage. Normally, the tubes shall extend from 6 in (150 mm) above the bottom of the shaft to at least 3 ft (0.9 m) above the top of the shaft, or 2 ft (0.6 m) above the ground surface if the shaft is cut off below the ground surface. If cross-hole acoustic tests are to be performed, the access tubes shall be filled with clean water no later than four (4) hours after placement of the concrete and the tubes capped during concrete placement to keep out concrete and debris. In all cases, the access tubes shall be as nearly parallel as possible and be placed as far from the longitudinal steel bars as possible.

Prior to the beginning of downhole logging, the Contractor shall assure that the Cross-Hole Acoustic Logging test probes can pass through every tube to the bottom. If a tube is obstructed, the entire length of the obstructed access tube will not be measured for payment. The Engineer may also require the Contractor to core a hole within the drilled shaft near and to the full depth of the obstructed tube. The cored hole shall be large enough to accommodate the test probe for the full length of the hole. The coring equipment, coring procedure and location of the core hole shall be approved by the Engineer before the coring process may begin. The coring method shall provide for complete core recovery and shall minimize abrasion and erosion of the core. The core hole shall be placed at a position in the shaft that will not produce damage to the reinforcing steel in the shaft. The core hole shall be logged, voids or defects indicated on the log, and the log submitted to the Engineer. Cores shall be preserved and made available for inspection by the Engineer. The core hole will be treated as an access tube for downhole testing. Core holes that are drilled to substitute for a blocked access tube shall be measured and paid for at the Contract unit price for Access Tubes.

Upon completion of all tests involving access tubes and after acceptance of the drilled shaft, the access tubes and core holes shall be filled with grout.

- 27. Evaluation and Acceptance or Rejection of Drilled Shafts:** Upon completion and integrity testing (if called for) of a drilled shaft, the Engineer will review all available drilling logs, drilled shaft construction logs, concreting logs, inspection reports, load test results, and integrity test results in order to determine the acceptability of the drilled shaft. If the Engineer determines that available data is inconclusive, the Engineer may call for additional integrity testing, coring, or other appropriate actions necessary for evaluating the drilled shaft. Should the additional integrity testing or coring confirm the presence of anomalies, the Contractor will not be compensated for the cost of the additional integrity testing or coring (even if the anomalies are determined to be non-critical and the shaft is found to be acceptable). Should additional integrity testing or coring demonstrate that anomalies are

not present (prior to any remedial work), the additional integrity testing or coring will be paid for by the Department. The Contractor may continue to construct drilled shafts before receipt of notice of acceptance of the tested shaft or shafts by the Engineer. If the Engineer finds previously-constructed shaft(s) to be unacceptable, the Contractor shall be required to repair, at its expense, the unacceptable shaft(s) to the satisfaction of the Engineer. The Contractor shall prove to the satisfaction of the Engineer, at no expense to the State, the acceptability of all shafts constructed since the time that the unacceptable shaft was constructed and to prove the acceptability of the procedure to be used in constructing future shafts. If the Engineer deems the construction procedure to be unacceptable, the Contractor shall cease all drilled shaft construction until submittal of a new construction procedure to the Engineer and the Engineer has accepted it.

The Contractor shall submit repair procedures to the Engineer for review and approval. If these plans involve change of or impact on the structural design of the shafts or shaft caps, or the geometry of the shafts, any proposed redesign of the Contractor's plan shall be performed at the Contractor's expense by a qualified Professional Engineer registered in the State of Connecticut.

The Engineer may require that additional shafts be tested. If the testing of the additional shaft(s) indicates the presence of a defect in any additional shaft, the testing cost for that shaft shall be borne by the Contractor, and the Contractor shall repair the shaft at its own expense, as above. Any additional testing required by the Engineer on repaired drilled shafts shall be considered part of the Contractor's remediation plan, to be paid for by the Contractor.

7.01.04 - Method of Measurement:

- 1. Furnishing Drilled Shaft Drilling Equipment:** There will be no measurement of the work performed under this Lump Sum item.
- 2. Drilled Shaft** will be measured for payment by the length in linear feet (meters) of the completed and accepted concrete drilled shaft, of the diameter and containing the reinforcement shown on the plans. The length will be determined as the difference between the plan top-of-shaft elevation and the final bottom-of-shaft elevation.
- 3. Drilled Shaft Earth Excavation** will be measured for payment by the length in linear feet (meters) of completed earth excavation of the diameter shown on the plans (measured along the centerline of the shaft), either from the top of existing grade elevation prior to drilling or from the bottom of the drilled shaft cap elevation (whichever is lower), to either the top of competent rock elevation (if the drilled shaft extends onto or into competent rock) or to the bottom of the shaft elevation (if the shaft does not extend onto or into competent rock).
- 4. Drilled Shaft Rock Excavation** will be measured for payment by the length in linear feet (meters) of completed rock excavation of the diameter shown on the plans, measured along the centerline of the shaft from the top-of-competent-rock elevation to the bottom-of-the-shaft elevation
- 5. Obstructions** will be measured for payment, after designation as an obstruction by the

Engineer, by the number of hours of work, or fraction thereof per obstruction, required to remove the obstruction.

6. **Trial Drilled Shaft** will be measured for payment by the authorized linear feet (meters) of trial shaft holes drilled to the diameter shown on the plans, completed (including backfill and restoration of area, when required) and accepted. The length of trial shaft holes will be determined as the difference between the existing ground surface elevation at the center of the trial shaft hole prior to drilling and the authorized bottom elevation of the hole.
7. **Exploration Test Borings** will be measured for payment by the length in linear feet (meters), measured from the existing grade elevation to the bottom elevation of the exploration hole, for each authorized exploration boring drilled.
8. **Permanent Casing** will be measured for payment by the length in linear feet (meters) of each diameter casing installed and accepted. The length to be paid will be measured along the casing from the top-of-the-shaft elevation or the top of the casing, whichever is lower, to the bottom of the casing at each shaft location where permanent casing is used.
9. **Access Tubes** will be measured for payment by the length in linear feet (meters) of unobstructed access tube, installed and accepted in the drilled shafts, to the depths shown on the plans

7.01.05 - Basis of Payment:

1. **Furnishing Drilled Shaft Drilling Equipment:** Payment for this item will be at the Contract lump sum price for "Furnishing Drilled Shaft Drilling Equipment" which will be considered full and complete payment for furnishing and moving the drilling equipment to the Site, setting up the equipment at the required locations, and removing the equipment from the Site.

Payment of sixty percent (60%) of the lump sum amount bid for this item will be made when all drilling equipment is on the Site, assembled and ready to drill foundation shafts. Payment of the remaining forty percent (40%) of the lump sum amount will be made when all shafts have been drilled, all shaft concrete has been placed to the top of the shaft, all defects are repaired, and all drilled shafts have been accepted by the State.

2. **Drilled Shaft:** Drilled shafts will be paid for at the Contract unit price per linear foot (meter) for "Drilled Shaft (Diameter)" complete and accepted in place, including submittals, concrete and reinforcing steel, all labor, equipment, materials, temporary casings, slurry, slurry technical representative, blasting (if allowed), protection of existing facilities or utilities, vibration monitoring and incidentals necessary to complete the drilled shaft.
3. **Drilled Shaft Earth Excavation:** This work will be paid for at the Contract unit price per linear foot (meter) for "Drilled Shaft Earth Excavation (Diameter)" complete, including all labor, equipment, materials, water control, and disposal of excavated material necessary.
4. **Drilled Shaft Rock Excavation:** Drilled shaft rock excavation will be paid for at the Contract unit price per linear foot (meter) for "Drilled Shaft Rock Excavation (Diameter)" complete, including all labor, equipment, materials, water control, and disposal of excavated

material necessary. No payment will be made for additional rock excavation or placement of additional shaft concrete resulting from blasting overbreak (if blasting is allowed).

- 5. Obstructions:** Removal of obstructions will be paid for at the Contract unit price per hour for "Obstructions" complete, including all labor, equipment, materials, excavation of obstructions, water control, disposal of excavated material necessary. If the Contractor chooses to use a larger shaft diameter for obstruction excavation, no additional compensation will be paid for performing such oversized obstruction excavation.
- 6. Trial Drilled Shaft:** Trial drilled shafts will be paid for at the Contract unit price per linear foot (meter) for "Trial Drilled Shaft (Diameter)" complete and accepted, including all labor, equipment, materials, excavation of the trial drilled shaft through whatever materials are encountered, to the bottom of shaft elevation shown on the plans or as authorized by the Engineer (using slurry approved by the Engineer as necessary), providing inspection facilities, backfilling the hole, restoring the Site as required, and all other expenses to complete the trial shaft.
- 7. Exploration Test Borings:** Soil samples, rock cores or both, of the diameter and length required and authorized by the Engineer will be paid for at the Contract unit price per linear foot (meter) for "Exploration Test Boring" complete, including drilling, extracting, packaging and classifying samples or cores, delivery of same to the Engineer, furnishing concrete or grout to fill the core hole, providing a written log of the hole, and all other expenses necessary.
- 8. Permanent Casing:** Permanent casings will be paid for at the Contract price per linear foot (meter) for "Permanent Casing (Diameter)" complete, including furnishing and placing the permanent casing in the shaft excavation.
- 9. Access Tubes:** Access tubes will be paid for at the Contract unit price per linear foot (meter) of unobstructed "Access Tubes" complete and accepted, installed in the drilled shafts to the depths shown on the plans, including the post-test grouting of the access tubes.

Pay Item	Pay Unit
Furnishing Drilled Shaft Drilling Equipment	l.s. (l.s.)
Drilled Shaft (Diameter)	l.f. (m)
Drilled Shaft Earth Excavation (Diameter)	l.f. (m)
Drilled Shaft Rock Excavation (Diameter)	l.f. (m)
Obstructions	hr. (hr.)
Trial Drilled Shaft (Diameter)	l.f. (m)
Exploration Test Boring	l.f. (m)
Permanent Casing (Diameter)	l.f. (m)
Access Tubes	l.f. (m)

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 7.02
PILES**

Delete the entire section and replace it with the following:

**SECTION 7.02
PILES**

7.02.01—Description

7.02.02—Materials

7.02.03—Construction Methods

7.02.04—Method of Measurement

7.02.05—Basis of Payment

7.02.01—Description: This item shall consist of furnishing and driving foundation piles of the type and dimensions designated. Piles shall conform to and be installed in accordance with these specifications, and at the location, and to the elevation, penetration and/or capacity shown on the plans, or as directed by the Engineer. If specified in the plans or directed by the Engineer, piles shall be tipped, shaped, reinforced or otherwise pointed and strengthened

Test piles shall be piles of the type specified, driven in advance of placing orders for the piles, for the purpose of determining length or bearing capacity of piles. The Contractor shall furnish the piles in accordance with an itemized order list which will be furnished by the Engineer, showing the number and length of all piles. When test piles are specified, the pile lengths shown on the plans are for estimating purposes only. The actual lengths to be furnished for production piles will be determined by the Engineer after the test piles have been driven.

7.02.02—Materials: Piles of the type indicated on the plans shall conform to the requirements of Articles M.09.02 and M.14.01.

7.02.03—Construction Methods

1. Pile Types:

(a) Timber Piles: The method of storing and handling timber piles shall be such as to avoid damage to the piles. Special care shall be taken to avoid breaking the surface of treated piles. Cant dogs, hooks, or pike-poles shall not be used. Cuts or breaks in the surface of treated piling shall be given three brush coats of hot creosote oil of approved quality, and hot creosote oil shall be poured into all bolt holes.

(b) Steel Piles: The methods of storing and handling steel piles shall be such as to prevent damage to the piles and to protect them from corrosion.

(c) Cast-In-Place Concrete Piles: Cast-in-place concrete piles shall be constructed by driving steel shells and filling them with concrete. Shells shall be continuously or incrementally tapered, or cylindrical, or a combination of continuously or incrementally

tapered lower sections, which are extended with cylindrical upper sections, unless otherwise provided in the plans or special provisions. The tapered portion of piles shall have a minimum tip diameter of 8 inches (200 millimeters) and shall change in diameter not less than 1 inch in every 12 feet (7 millimeters/meter). Cylindrical piles and the cylindrical extension portions of tapered piles shall have a minimum diameter of 12 inches (300 millimeters). Shells for cast-in-place concrete piles shall be formed by joining sections of the same manufacture, unless otherwise permitted by the Engineer. Composite shell piles, which are piles composed of different thicknesses or of different manufacture, shall not be used unless shown on the plans or approved by the Engineer. Prefabricated driving points or other type tip enclosures shall be subject to the approval of the Engineer.

The Contractor shall furnish shells of a type and gage which can be driven without distortion. Shells which fail, fracture or otherwise distort during driving or after driving shall be withdrawn or replaced at the Contractor's expense. The metal of shells which are to be driven without a mandrel shall be of sufficient thickness to withstand the driving without failure, fracture or distortion, but in no case shall the thickness be less than No. 7 gage. Shells driven with a mandrel shall have a thickness not less than No. 18 gage. Piles having a shell thickness less than No. 9 gage shall be reinforced as shown on the plans.

Composite shell piles formed by extending lower sections of No. 7 or heavier gage, with upper sections of lighter than No. 7 gage, shall be driven with an internal mandrel in such a manner so as to insure shell alignment and maximum hammer energy transmission throughout the pile shell length. All details concerning compatibility of shell and mandrel construction shall be subject to the approval of the Engineer.

After driving has been completed, the shell shall be inspected and approved before any concrete is placed. The Contractor shall provide suitable lights and other equipment necessary to inspect each shell throughout its length.

All seams, joints and splices in shells shall develop the full strength of the shell and shall be watertight. Damaged shells that are unacceptable to the Engineer shall be filled with sand and a replacement shell or shells shall be driven adjacent thereto.

Reinforcement shall be placed in accordance with the requirements of the plans or special provisions.

No concrete shall be placed in a pile until all driving within a radius of 15 feet (4.5 meters) from the pile has been completed, or until all the shells for any one bent have been completely driven. If this is not practical, all driving within the above limits shall be discontinued until the concrete in the last pile cast has set at least 7 days.

Concrete shall be placed continuously in each pile, care being used to fill every part of the shell, and to work concrete around the reinforcement without displacing it. No concrete shall be placed in shells containing an accumulation of water or any foreign material.

Extensions, or "build-ups" on concrete piles, shall be avoided; but when necessary, they shall be made as specified in Subarticle 7.02.03-7.

(d) Prestressed Concrete Piles (Pretensioned): The piles shall be manufactured in accordance with the provision of Article 5.14.03, except as follows:

(1) Forms: The forms for the piles shall be of substantial construction and shall produce a uniformly smooth surface on all formed sides. A minimum concrete cover of 2 inches (50 millimeters) shall be maintained for prestressing elements by the use of spreaders or by bundling in areas adjacent to openings or inserts. Ties shall also have a minimum cover of 2 inches (50 millimeters) at these locations. Side forms carrying no load may be removed after 24 hours with the permission of the Engineer or after the concrete has reached the minimum transfer strength as required by Subarticle M.09.02-6.

(2) Finishing: The topside surface of the piles shall be given a uniformly smooth steel trowel finish to match the surface of the formed sides. The prestressing elements shall be cut flush or recessed 1/8 inch (3 millimeters) to the top of the pile. Projecting fins and surface imperfections shall be removed in a workmanlike manner. Exposed jet pipe connections, inserts or other devices shall be removed or recessed to a depth as directed, and the hole or opening patched with non-shrink grout in a workmanlike manner. The patching material shall have a degree of finish comparable to the adjacent surfaces. Additional finishing of piles, if required, shall be as shown on the plans or as otherwise directed.

(3) Handling and Storage: Care shall be taken during storage, transporting, hoisting and handling of the prestressed piles to prevent cracking or damage. Damaged piles shall be replaced by the Contractor at his expense. Lifting and support points shall be marked on the piles as required.

(4) Pile Extensions: Pile extensions shall normally be fabricated for this purpose in accordance with the specifications. However, sound sections of pile cutoffs or sound portions of rejected piles may be used, subject to the approval of the Engineer. Short pile extensions may, with the permission of the Engineer, be cast-in-place monolithically with the footing or cap.

2. Pile Driving Equipment:

(a) Hammers: Piles shall be driven with approved air, steam, diesel, or hydraulic hammers or a combination of acceptable hammer and water jet. The plant and equipment furnished for air/steam hammers shall have sufficient capacity to maintain at the hammer, under working conditions, the volume and pressure specified by the manufacturer. The plant and equipment shall be equipped with accurate pressure gauges which are easily accessible to the Engineer. The valve mechanism and other parts of the hammer shall be properly maintained so that the length of stroke for a single-acting hammer and the number of blows per minute for a double-acting hammer will be obtained. The power plant for hydraulic hammers shall have sufficient capacity to maintain at the hammer, under working conditions, the volume and pressure specified by the manufacturer. The power plant and equipment shall be equipped with accurate pressure gauges which are easily accessible to the Engineer.

The size of hammer shall be adapted to the type and size of piles and the driving conditions. Unless otherwise specified, the minimum rated striking energy per blow for

hammers used shall be 7,000-foot pounds (9,500 joules) for driving timber piles; 15,000-foot pounds (20,000 joules) for driving steel piles and for driving shells for cast-in-place concrete piles; and 19,000-foot pounds (25,000 joules) for driving precast concrete piles and for driving prestressed concrete piles. The hammer model used for the driving of test piles shall be used for the driving of service or production piles, unless a change is authorized by the Engineer in writing. Hammers delivering an energy which the Engineer considers detrimental to the piles shall not be used.

Non-impact hammers, such as vibratory hammers, or driving aids such as jets, followers, pre-augered and prebored holes shall not be used unless either specifically permitted in writing by the Engineer or stated in the contract documents.

(b) Pile Hammer Approval: All pile driving equipment furnished by the Contractor shall be subject to the approval of the Engineer. All pile driving equipment shall be sized in such a way that the piles can be driven with reasonable effort to the ordered lengths without damage. Approval of pile driving equipment by the Engineer will be based on wave equation analysis and/or other judgments. In no case shall the driving equipment be used without written approval of the Engineer. Prerequisite to such approval, the Contractor shall submit to the Engineer the necessary pile driving equipment information and wave equation analysis at least 30 days prior to driving piles. The wave equation analysis shall be signed, sealed and dated by a Connecticut licensed Professional Engineer.

The criteria that the Engineer will use to evaluate the driving equipment consists of both the required number of hammer blows per foot (per 0.25 meters) as well as the pile stresses at the required ultimate pile capacity. The required number of hammer blows indicated by the wave equation at the ultimate pile capacity shall be between 36 and 180 blows per foot (29 and 147 blows per 0.25 meters) for the driving equipment to be acceptable. In addition, for the driving equipment to be acceptable the pile stresses which are indicated by the wave equation to be generated by the driving equipment shall not exceed the maximum driving stresses allowed by the governing design code stated in the contract documents.

During pile driving operations, the Contractor shall use the approved system. No variations in the driving system will be permitted without the Engineer's written approval. Any change in the driving system will only be considered after the Contractor has submitted the necessary information for a revised wave equation analysis.

If the Engineer determines the Contractor's hammer is unable to transfer sufficient energy to the pile, the hammer shall be removed from service until repaired to the satisfaction of the Engineer.

(c) Drive System Components and Accessories:

(1) Hammer Cushion: Impact pile driving equipment designed to be used with a hammer cushion shall be equipped with a suitable thickness of hammer cushion material to prevent damage to the hammer or pile and to insure uniform driving behavior. Hammer cushions shall be made of durable manufactured materials, provided in accordance with the hammer manufacturer's guidelines. Wood, wire rope, and asbestos hammer cushions are specifically disallowed and shall not be

used. A striker plate as recommended by the hammer manufacturer shall be placed on the hammer cushion to insure uniform compression of the cushion material. The hammer cushion shall be removed from the helmet and inspected prior to beginning pile driving at each structure or after each 100 hours of pile driving, whichever is less. The Contractor shall replace any hammer cushion whose thickness is less than 75% of the original thickness.

(2) Helmet: Piles driven with impact hammers require an adequate helmet or drive head to distribute the hammer blow to the pile head. The helmet shall be axially aligned with the hammer and the pile. The helmet shall be guided by the leads and not be free-swinging. The helmet shall fit around the pile head in such a manner as to prevent transfer of torsional forces during driving, while maintaining proper alignment of hammer and pile. For steel and timber piling, the pile heads shall be cut squarely and a helmet, as recommended by the hammer manufacturer, shall be provided to hold the axis of the pile in line with the axis of the hammer. For precast concrete and prestressed concrete piles, the pile head shall be plane and perpendicular to the longitudinal axis of the pile to prevent eccentric impacts from the helmet. For special types of piles, appropriate helmets, mandrels or other devices shall be provided in accordance with the manufacturer's recommendations so that the piles may be driven without damage.

(3) Pile Cushion: The heads of concrete piles shall be protected by a pile cushion. Pile cushions shall be made of plywood, hardwood, or composite plywood and hardwood materials. The minimum pile cushion thickness placed on the pile head prior to driving shall be at least 4 inches (100 millimeters). A new pile cushion shall be provided for each pile. In addition the pile cushion shall be replaced if, during the driving of any pile, the cushion is compressed more than one-half the original thickness or it begins to burn. The pile cushion dimensions shall match the cross sectional area of the pile top. The use of manufactured pile cushion materials in lieu of a wood pile cushion shall be evaluated on a case by case basis.

(4) Leads: Piles shall be supported in line and position with leads while being driven. Pile driver leads shall be constructed in a manner that affords freedom of movement of the hammer while maintaining alignment of the hammer and the pile to insure concentric impact for each blow. Leads may be either fixed or swinging type. Swinging leads, when used, shall be fitted with a pile gate at the bottom of the leads and, in the case of batter piles, a horizontal brace may be required between the crane and the leads. The pile section being driven shall not extend above the leads. The leads shall be adequately embedded in the ground or the pile constrained in a structural frame such as a template to maintain alignment. The leads shall be of sufficient length to make the use of a follower unnecessary, and shall be so designed as to permit proper alignment of batter piles.

(5) Followers: Followers shall only be used when approved in writing by the Engineer, or when specifically stated in the contract documents. In cases where a follower is permitted, the first pile in each bent and every tenth pile driven thereafter shall be driven full length without a follower, to determine that adequate pile penetration is being attained to develop the ultimate pile capacity. The follower and pile shall be held and maintained in equal and proper alignment during driving. The follower shall be of such material and dimensions to permit the piles to be driven to the penetration depth

determined necessary from the driving of the full length piles. The final position and alignment of the first two piles installed with followers in each substructure unit shall be verified to be within the required location tolerances before additional piles are installed.

(6) Jets: Jetting shall only be permitted if approved in writing by the Engineer or when specifically stated in the contract documents. When jetting is not required in the contract documents, but approved after the Contractor's request, the Contractor shall determine the number of jets and the volume and pressure of water at the jet nozzles necessary to freely erode the material adjacent to the pile without affecting the lateral stability of the in place pile. When jetting is specifically required in the contract documents, the plant shall have sufficient capacity to deliver at all times at least 100 psi (700 kilopascals) pressure at two 3/4-inch (19 millimeter) jet nozzles. In either case, unless otherwise indicated by the Engineer, jet pipes shall be removed when the pile toe is a minimum of 5 feet (1.5 meters) above prescribed toe elevation and the pile shall be driven to the required ultimate pile capacity with an impact hammer. Also, the Contractor shall control, treat if necessary, and dispose of all jet water in a manner satisfactory to the Engineer and in accordance with the provisions of Article 1.10.

(7) Pre-Augering: When stated in the contract documents, the Contractor shall pre-auger holes at pile locations to the depths shown on the plans. Pre-augered holes shall be of a size smaller than the diameter or diagonal of the pile cross section; however, large enough to allow penetration of the pile to the specified depth. If subsurface obstructions, such as boulders or rock layers, are encountered, the hole diameter may be increased to the least dimension which is adequate for pile installation. Any void space remaining around the pile after completion of driving shall be filled with sand or other approved material. The use of spuds shall not be permitted in lieu of pre-augering. Augering, wet-rotary drilling, or other methods of pre-augering shall be used only when approved by the Engineer. When permitted, such procedures shall be carried out in a manner which will not impair the capacity of the piles already in place or the safety of existing adjacent structures. If the Engineer determines that pre-augering has disturbed the capacities of previously installed piles, those piles that have been disturbed shall be restored to conditions meeting the requirements of this specification by redriving or by other methods acceptable to the Engineer. Redriving or other remedial measures shall be instituted after the pre-augering operations in the area have been completed.

3. Pile Capacity

(a) Ultimate Pile Capacity: Piles shall be driven by the Contractor to the penetration depth shown on the plans or to a greater depth if necessary to obtain the ultimate pile capacity. The ultimate pile capacity shall be as defined in the contract documents.

Jetting or other methods shall not be used to facilitate pile penetration unless specifically permitted in the contract documents or in writing by the Engineer. The ultimate pile capacity of jetted piles shall be based on driving resistances recorded during impact driving after the jet pipes have been removed. Jetted piles not attaining the ultimate pile capacity at the ordered length shall be spliced, as

required, at the Contractor's cost, and driven with an impact hammer until the ultimate pile capacity is achieved.

The ultimate pile capacity of piles driven with followers shall only be considered acceptable when the follower driven piles attain the same pile toe elevation or top of bedrock elevation as required for the full length piles driven without followers that attained the required ultimate pile capacity.

(b) Wave Equation: The ultimate pile capacity shall be determined by the Engineer. Piles shall be driven with the approved driving equipment to the ordered length or other lengths necessary to obtain the required ultimate pile capacity. Jetting or other methods to facilitate pile penetration shall not be used unless specifically permitted either in the contract documents or approved by the Engineer after a revised driving resistance is established from the wave equation analysis. Adequate pile penetration shall be considered to be obtained when the specified wave equation resistance criteria is achieved within 5 feet (1.5 meters) of the pile toe elevation, based on ordered length. Piles not achieving the specified resistance within these limits shall be driven to penetrations established by the Engineer.

(c) Static Load Tests: Compression load tests shall be performed by procedures set forth in ASTM D-1143 using the quick load test method, except that the test shall be taken to plunging failure or the capacity of the loading system. Testing equipment and measuring systems shall conform to ASTM D-1143, except that the loading system shall be capable of applying 150% of the ultimate pile capacity as stated in the contract documents, and that a load cell and spherical bearing plate shall be used. The apparatus shall be constructed to allow the various increments of the load to be placed gradually, without causing vibration to the test pile. The Contractor shall submit to the Engineer for approval working drawings of the loading apparatus in accordance with Article 1.05.02. When the approved method requires the use of tension (reaction) piles, the tension piles, when feasible, shall be of the same type and diameter as the production piles, and shall be driven in the location of permanent piles except that timber or tapered piles installed in permanent locations shall not be used as tension piles.

The top elevation of the test pile shall be determined immediately after driving and again just before load testing to check for heave. Any pile which heaves more than 1/4 inch (6 millimeters) shall be redriven or jacked to the original elevation prior to testing. Unless otherwise specified in the contract, a minimum 3-day waiting period shall be observed between the driving of any anchor piles or the load test pile and the commencement of the load test.

On completion of the load testing, any test or anchor piling not a part of the finished structure shall be removed or cut off at least 1 foot (300 millimeters) below either the bottom of footing or the finished ground elevation, if not located within the footing area.

(d) Dynamic Pile Driving Analysis (PDA) Test: Dynamic measurements following procedures set forth in ASTM D-4945 will be taken during the driving of piles designated as dynamic monitoring test piles. The Contractor shall employ a qualified specialty Consultant, which has successfully completed no less than ten

dynamic pile driving tests, to perform the testing and report preparation for all Dynamic Pile Driving Analysis (PDA) Tests to be performed.

At least thirty days prior to driving the test piles the Contractor shall submit to the Engineer for review and approval the qualified specialty consultant, as well as the complete installation, and testing procedures. The submittal shall include all necessary pile driving equipment and support facilities to drive the piles to capacities and depths shown on the plans within allowable stress limits. As part of the submittal the Contractor's Consultant shall perform a wave equation analyses, and a summary report confirming that the pile driving system proposed by the Contractor can meet the capacity, driving resistance and allowable stress limits.

All equipment necessary for the dynamic monitoring of the piles such as gages, cables, etc., shall be furnished by the Contractor's Consultant. The equipment shall conform to the requirements of ASTM D-4945, Standard Test Method for High Strain Dynamic Testing of Piles, and be capable of testing the pile to one and one-half times the ultimate pile capacity. An experienced engineer, who has successfully completed no less than ten dynamic pile driving tests, shall operate the Pile Driving Analyzer in the field. The Contractor shall furnish a shelter within 100 feet (30 meters) of test location(s) to protect the dynamic test equipment from the elements. The shelter shall be a minimum floor size of 400 square feet (40 square meters), with a minimum ceiling height of 7 feet (2 meters), and an inside temperature maintained between 50° and 85°F (10° and 29°C).

The Contractor shall provide power to the test pile locations for the duration of the dynamic testing. The power supply shall consist of a power source providing 115-Volt alternating current with a frequency of 60 Hz and a minimum of 2 kilowatts. If field generators are used as the power source, provide functioning meters to monitor power voltage and frequency. Direct current welders or non-constant power sources are unacceptable.

Prior to lifting the pile to be dynamically tested, the Contractor shall provide as a minimum 3 feet (1 meter) of clear access to 180 degree opposite faces of the pile for pile preparation. The Contractor or its Consultant shall then drill and prepare holes in the pile for gage attachment.

The Contractor or its Consultant shall attach the gages to the pile before driving the piles. Pile driving shall be performed using routine pile installation procedures. When the level of the gages is within 1 foot (300 millimeters) of the ground surface, or obstruction, driving shall be halted to remove the gages from the pile. If additional driving is required, the pile shall be spliced and gages shall be reattached to the head of the next pile segment.

With the dynamic testing equipment attached, the Contractor shall drive the pile to the design penetration depth or to a depth determined by the Engineer. The Engineer will use the ultimate pile capacity estimates at the time of driving and/or restriking from dynamic test methods to determine the required pile penetration depth for the ultimate pile capacity. The stresses in the piles will be monitored during driving with the dynamic test equipment to ensure that the actual driving stresses do not exceed the maximum allowed values. If necessary, the Contractor

shall reduce the driving energy transmitted to the pile by using additional cushions or reducing the energy output of the hammer in order to maintain driving stresses below the maximum values. If non-axial driving is indicated by dynamic test equipment measurements, the Contractor shall immediately realign the driving system.

After the initial drive of the pile, the Contractor shall wait 24 hours, or the time specified in the contract documents, and restrike the dynamic monitoring test pile with the dynamic testing instruments attached. A cold hammer shall not be used for the restrike. The hammer shall be warmed up before restrike begins by applying at least 20 blows to another pile. The maximum amount of penetration required during restrike shall be 6 inches (150 millimeters), or 50 hammer blows, whichever occurs first.

The Contractor's Consultant shall provide preliminary estimates of pile capacity of the test pile to the Engineer within 24 hours of the restrike of each tested pile. The Contractor's Consultant shall also prepare and submit a written report within 5 calendar days of the completion of the testing. This report shall contain a discussion of the pile capacity obtained from the dynamic testing. CAPWAP analyses of the dynamic testing data shall be performed on data obtained at the end of initial driving and the beginning of restrike. The Engineer may request additional analyses at selected pile penetration depths. The report shall also discuss hammer and driving system performance, driving stress levels, and pile integrity. The report is to be prepared, signed, sealed and dated by a Connecticut licensed Professional Engineer. No production piles can be driven until the report has been submitted and approved by the Engineer.

4. Test Piles and Order Lists: Test piles shall be driven at the locations shown on the plans and to the penetration depths specified by the Engineer. Test piles shall be driven to a driving resistance established by the Engineer at the estimated pile toe elevation. The Contractor shall excavate the ground at each test pile to the elevation of the bottom of the footing before the pile is driven. All test piles shall be driven with impact hammers unless specifically stated otherwise in the plans. In general, the specified length of test piles will be greater than the estimated length of production piles in order to provide for variation in soil conditions. The driving equipment used for driving test piles shall be identical to the equipment proposed for driving the production piling. Approval of driving equipment shall conform to the requirements of these Specifications.

Test piles that do not attain the specified driving resistance at a depth of 6 inches (150 millimeters) above the estimated pile tip elevation, or are specified as a dynamic monitoring pile, shall be redriven after being allowed to set up. The minimum time period before restrike shall be 24 hours, or as specified in the contract documents. A cold hammer shall not be used for the restrike. The hammer used shall be warmed up by applying at least 20 blows to another pile.

Unless otherwise specified in the contract documents, the Contractor shall not order piling to be used in the permanent structure until test pile data has been reviewed and pile order lengths are authorized by the Engineer. The Engineer will provide the pile order list after completion of the test pile(s) and dynamic pile driving analysis (PDA) tests and/or pile loading tests specified in the contract documents.

When no test piles are specified for a substructure, the estimated pile lengths in the contract documents are taken as the pile order length.

The lengths given in the order list will be based on the lengths which are assumed after cutoff to remain in the completed structure. The Contractor shall, without added compensation, increase the lengths to provide for fresh heading and for such additional length as may be necessary to suit the Contractor's method of operation.

5. Pile Preparation and Driving: The heads of all piles shall be plane and perpendicular to the longitudinal axis of the pile before the helmet is attached. Approval of a pile hammer relative to driving stress damage shall not relieve the Contractor of responsibility for piles damaged because of misalignment of the leads, failure of cushion materials, failure of splices, malfunctioning of the pile hammer, or other improper construction methods. Piles damaged for such reasons shall be rejected and replaced at the Contractor's expense when the Engineer determines that the damage impairs the strength of the pile.

If it becomes necessary and is authorized by the Engineer to resort to jetting, spudding or pre-holing — and further, if no contract bid price is asked for in the proposal for jetting, spudding, or pre-holing — such work will be paid for as "extra work" in accordance with Articles 1.04.05 and 1.09.04.

The use of a hammer with a greater mass, or the use of piles manufactured or designed with pile tips of a nature to provide for better penetration such as but not limited to composite shells, tapered sections or H-pile sections, shall not be considered as extra work. Authorized point reinforcement for piles shall be a separate item.

Piles for exposed pile bents shall be driven with pile driver leads and templates. They shall be of rigid design and construction and shall maintain the required position and alignment of the piles within the tolerances hereinafter specified. Templates shall be anchored or spudded into position, shall be capable of guiding all piles required for the bent and shall remain in place until all the piles in the bent are driven.

(a) Location and Alignment Tolerance: Piles shall be driven with a variation of not more than 1/4 inch per foot (20 millimeters/meter) from the vertical or from the batter line indicated, except that piles for trestle bents shall be so driven that the cap may be placed in its proper location without inducing excessive stresses in the piles. Upon completion of driving and released from leads, exposed piles such as in bents shall not have a variation of more than 2 inches (50 millimeters) at the cut-off elevation from the position shown on the plans. Unless otherwise permitted in writing by the Engineer, failure to meet this tolerance shall be cause for rejection. Other foundation piles shall not be out of the position shown on the plans more than 6 inches (150 millimeters) after driving. The Engineer may require that driving be stopped in order to check the pile alignment. Pulling laterally on piles to correct misalignment, or splicing a properly aligned section on a misaligned section shall not be permitted.

If the location and/or alignment tolerances specified are exceeded, the extent of overloading shall be evaluated by the Engineer. If in the judgment of the Engineer, corrective measures are necessary, suitable measures shall be designed and constructed by the Contractor.

(b) Heaved Piles: Level readings to measure pile heave after driving shall be made by the Contractor at the start of pile driving operations and shall continue until the Engineer determines that such checking is no longer required. Level readings shall be taken immediately after the pile has been driven and again after piles within a radius of 15 feet (4.5 meters) have been driven. If pile heave is observed, the Contractor shall take accurate level readings referenced to a fixed datum on all piles immediately after installation and periodically thereafter as adjacent piles are driven to determine the pile heave range. All piles that have been heaved more than $\frac{1}{4}$ inch (6 millimeters) shall be redriven at the Contractor's cost, to the required resistance or penetration. Concrete shall not be placed in pile casings until pile driving has progressed beyond a radius of 15 feet (4.5 meters) from the pile to be concreted. If pile heave is detected for pipe or shell piles which have been filled with concrete, the piles shall be redriven to original position after the concrete has obtained sufficient strength and a proper hammer-pile cushion system, satisfactory to the Engineer, is used.

(c) Installation Sequence: The order of placing individual piles in pile groups shall be either starting from the center of the group and proceeding outwards in both directions or starting at the outside row and proceeding progressively across the group.

6. Unsatisfactory Piles: The method used in driving piles shall not subject the piles to excessive or undue abuse producing crushing and spalling of concrete, injurious splitting, splintering, and brooming of the wood, or deformation of the steel. Misaligned piles shall not be forced into proper position. Any pile damaged during driving by reason of internal defects, or by improper driving, or driven out of its proper location, or driven below the designated cutoff elevation, shall be corrected by the Contractor by a method approved by the Engineer.

Piles which have been bent during installation shall be considered unsatisfactory unless the ultimate capacity is proven by load tests performed at the Contractor's expense. If such tests indicate inadequate capacity, corrective measures as determined by the Engineer shall be taken, such as use of bent piles at reduced capacity, installation of additional piles, strengthening of bent piles, or replacement of bent piles.

A concrete pile will be considered defective if a visible crack, or cracks, appears around the entire periphery of the pile, or if any defect is observed which, as determined by the Engineer, affects the strength or life of the pile.

7. Splicing Piles and Extensions: Full length piles shall be used when practicable; but if splices cannot be avoided, piles or shells for cast-in-place piles may be spliced in accordance with the requirements of the plans. Piles shall not be spliced except with the approval of the Engineer. Splices in excess of two per pile for timber, steel and cast-in-place concrete piles will not be permitted except with special permission of the Engineer. Only one splice per pile will be permitted in precast concrete or prestressed concrete piles. In the absence of splice details in the plans, piles or shells for cast-in-place concrete piles shall be spliced in accordance with the pile or shell manufacturer's recommendations, subject to the approval of the Engineer. Working Drawings for prefabricated splicing devices and their method of installation shall be submitted to the Engineer for review. All seams, joints and splices shall develop the full strength of the pile.

8. Point Reinforcement: When directed by the Engineer, the contractor shall point-reinforce piles. Such point-reinforcement shall be in accordance with the plans or as directed.

9. Cutoff Lengths: The pile head of all permanent piles and pile casings shall be cutoff at the elevation shown on the plans or as ordered by the Engineer. All cutoff lengths shall become the property of the Contractor, and shall be removed by the Contractor from the site of the work.

10. Painting Steel Piles and Steel Pile Shells: When steel piles or steel pile shells extend above the ground surface or water surface, they shall be painted as specified elsewhere in the contract documents or as ordered by the Engineer. This protection shall extend from an elevation 2 feet (600 millimeters) below the ground or water surface to the top of the exposed steel.

11. Welding on Piles: When required or permitted, all welding on piles shall be done in accordance with the requirements of the current AWS Structural Welding Code.

7.02.04—Method of Measurement

1. Steel Piles-Timber Piles-Precast Concrete Piles: The length of (type) piles which will be the basis for the pay computation to be included under the item of furnishing (type) piles, shall be number of linear feet (meters) of (type) piles authorized by the Engineer or actually furnished by the Contractor, whichever is the lesser amount.

Length of pile cutoffs previously paid for under authorized lengths of piles and subsequently incorporated into the work will not be measured for payment.

The work, materials, tools, equipment and labor incidental to the disposal of pile cutoffs will not be measured for payment.

The amounts to be included under the item for driving (type) piles will be the number of linear feet (meters) of piles actually driven and accepted in the completed structure.

2. Cast-in-Place Concrete Piles: The amount to be included under the item of cast-in-place concrete piles shall be the number of linear feet (meters) of piles actually driven and accepted in place in the completed structure.

Cut-off materials from shells shall remain the property of the Contractor. They will be paid for in accordance with the unit cost applying in the Contractor's bill or bills for such shells, except that no payment will be made of material cut off from shells furnished by the Contractor in excess of the ordered length. The unit of measurement will be the unit applying in the Contractor's bill or bills for such shells. Material cut off from shells furnished by the Contractor in lengths in excess of those ordered by the Engineer will not be measured for payment hereunder. The work, materials, tools, equipment and labor incidental to the disposal of cutoffs will not be measured for payment.

Reinforcement, if required in cast-in-place concrete piles, will not be measured for payment.

3. Prestressed Concrete Piles (Pretensioned): The length of the prestressed concrete piles, which will be the basis for the pay computation, shall be the number of linear feet (meters) of piles authorized by the Engineer or actually furnished by the Contractor, whichever is the lesser amount. The length of any specified pile tip protruding from the concrete will be included in the length measured for payment.

Also included in the length measured for payment will be the length of precast pile extensions ordered by the Engineer. Not to be included, however, is the length of pile extension furnished in excess of the ordered length. The length of projection dowels shall not be included in the length measured for payment.

Extensions to prestressed concrete piles which are poured monolithically with the footing or pier cap will be paid for at the Contract unit prices for the several items involved, which prices shall be full compensation for all materials, tools, equipment and labor necessary to the completion of the work.

Cut-offs shall not be used for pile extension. The work, material, tools equipment and labor incidental to the disposal of cutoffs will not be measured for payment.

The amounts to be included under the item for driving prestressed concrete piles shall be the number of linear feet (meters) of piles actually driven and accepted in the completed structure.

4. Test Piles: The amounts to be included under the respective items for test piles, of the type and length specified, shall be the number of test piles actually driven and accepted. Lengths of test piles ordered by the Engineer in excess of the length or lengths specified in the contract will be measured for payment by the actual number of linear feet (meters) ordered, furnished and accepted by the Engineer. Driving of such pile extensions will be measured for payment by the actual length driven and left in place.

Authorized splices performed on test piles will be measured for payment by the number of authorized splices actually completed and accepted. Splicing of test piles shall not be considered as authorized splices when such splicing is done to complete piles to the test pile length specified in the contract.

5. Static Load Tests: The amount to be included under the item of static loading tests shall be the actual number of static load tests completed and accepted.

6. Dynamic Pile Driving Analysis (PDA) Test: The amount to be included under this item shall be the actual number of piles which are driven and restruck with dynamic monitoring equipment attached, completed and accepted

7. Splices: The amount to be included under the items for splicing timber, steel, cast-in-place concrete, precast concrete and prestressed concrete piles (pretensioned) shall be the number of authorized pile splices actually completed and accepted. The splicing of timber and steel piles, steel shells for cast-in-place concrete piles, precast concrete piles and prestressed concrete piles (pretensioned) shall not be considered as authorized splices when such splicing is performed to complete piles to the order lengths, as defined in Subarticle 7.02.03-7, or when the furnished lengths of such piles are less than the order lengths approved by the Engineer.

8. Point Reinforcement for Piles: The amount to be included under the item of "Point Reinforcement for Piles" for the type of piles specified shall be the number of authorized reinforced points actually completed and accepted.

9. Pre-Augering of Piles: The amount to be included under the item "Pre-Augering of Piles" shall be the number of linear feet (meters) of pre-augering completed and accepted by the Engineer.

7.02.05--Basis of Payment: This work will be paid for as follows:

1. Steel Piles: Payment for furnishing steel piles of the lengths authorized will be at the Contract unit price per pound (kilogram) for "Furnishing Steel Piles," which price shall include furnishing, delivery, storage and handling, and all materials, equipment, tools and labor incidental thereto. The weight (mass) of steel pile caps will be included with and paid for under this item.

Payment for driving steel piles will be at the contract unit price per linear foot (meter) for "Driving Steel Piles," complete in place, which price shall include all materials, equipment, tools and labor incidental thereto.

2. Timber Piles: Payment for furnishing timber piles or treated timber piles, up to a length 10 feet (3 meters) greater than that specified on the plans or in the proposal form, will be at the Contract unit price per foot (meter) for "Furnishing Timber Piles (' Length)" and "Furnishing Treated Timber Piles (' Length)," respectively, which price shall include furnishing, delivery, peeling, storage and handling, and all materials, equipment, tools and labor incidental thereto.

In case the length of any piles finally ordered is more than 10 feet (3 meters), but less than 20 feet (6 meters), greater than the length specified on the plans or proposal form, payment for furnishing such piles shall be at a price per linear foot (meter) equal to the original contract price, plus 20 percent thereof.

In case the length of any piles finally ordered is 20 feet (6 meters) or more greater than the length specified on the plans or proposal form, payment for furnishing such piles shall be at a price per linear foot (meter) equal to the original contract price plus 40 percent thereof.

Payment for driving timber piles or treated timber piles will be at the contract unit price per linear foot (meter) for "Driving Timber Piles" and "Driving Treated Timber Piles," respectively, complete in place and regardless of length, which price shall include all materials, equipment, tools and labor incidental thereto.

3. Cast-in-Place Concrete Piles: Payment for cast-in-place concrete piles will be at the contract unit price per linear foot (meter) for "Cast-in-Place Concrete Piles," complete in place, including all materials, equipment, tools and labor incidental thereto.

Cut-off materials from shells shall remain the property of the Contractor. They will be paid for in accordance with the unit cost applying in the Contractor's bill or bills for such shells, except that no payment will be made for material cut off from shells furnished by the Contractor in excess of the ordered length.

4. Prestressed Concrete Piles: Payment for furnishing prestressed concrete piles, of the lengths required, will be at the contract unit price per linear foot (meter) for "Furnishing Prestressed Concrete Piles" of the type and size as shown on the plans, which price shall include furnishing, delivery, storage and handling, and all materials, equipment, tools and labor incidental thereto.

Payment for driving prestressed concrete piles will be at the contract unit price per linear foot (meter) for "Driving Prestressed Concrete Piles," complete in place, which price shall include all material, equipment, tools and labor incidental thereto. Also included shall be all work involved in cutting piles to the direct cut-off elevation.

5. Test Piles: Test piles will be paid for at the contract unit price each for "Test Pile," of the type and length specified, which price shall constitute the complete compensation for furnishing and driving test piles and shall include all materials, equipment, tools and labor incidental thereto. Authorized splices to test piles will be paid for at 200 percent of the contract unit price bid for Splicing Timber Piles, Splicing Steel Piles, Splicing Cast-in-Place Piles or Splicing Prestressed Concrete Piles, whichever type of test pile the splice has been performed on; and such payment shall be for all costs including materials, equipment, tools and labor incidental thereto.

Extension to test piles in excess of the specified length will be paid for on the following basis, which shall include all equipment, tools, splices, labor and work incidental thereto.

(a) Timber Test Piles: Extensions will be paid for at 125 percent of the contract unit price per linear foot (meter) for "Furnishing Timber Piles," of the shortest length specified in the proposal, and at 125 percent of the contract unit price per linear foot (meter) for "Driving Timber Piles."

(b) Steel Test Piles: Extensions will be paid for at 125 percent of the contract unit price per pound (kilogram) for "Furnishing Steel Piles" and at 125 percent of the contract unit price per linear foot (meter) for "Driving Steel Piles."

(c) Cast-in-Place Concrete Test Piles: Extensions will be paid for at 125 percent of the contract unit price per linear foot (meter) for "Cast-in-Place Concrete Piles." Cut-off materials from shells will be paid for as provided in Subarticle 7.02.05-3.

(d) Prestressed Concrete Test Piles: Extensions will be paid for at 125 percent of the contract unit price per linear foot (meter) for "Furnishing Prestressed Concrete Piles," and at 125 percent of the contract unit price per linear foot (meter) for "Driving Prestressed Concrete Piles."

6. Static Load Tests: Loading tests will be paid for at the contract unit price each for "Pile Loading Test," which price shall include all expenses incidental to loading the pile or group of piles and removing the load, platform, etc., upon completion of the test.

7. Dynamic Pile Driving Analysis (PDA) Test: Dynamic monitoring will be paid for at the contract unit price each for "Dynamic Pile Driving Analysis (PDA) Test" which price shall include complete compensation for each pile tested using a pile driving analyzer during driving and restrike, including all materials, equipment, tools and labor incidental thereto, as well as providing preliminary and summary report(s).

8. Splices: Authorized splices in timber, steel, cast-in-place piles, precast concrete and prestressed concrete piles will be paid for at the contract unit price each for "Splicing Timber Piles," "Splicing Steel Piles," "Splicing Cast-in-Place Concrete Piles," "Splicing Precast Concrete Piles," "Splicing Prestressed Concrete Piles," respectively, which price shall include all materials, except as otherwise noted, and all equipment, tools and labor incidental thereto. In the absence of such prices, authorized splices will be paid for as extra work.

9. Trimming and Cutting: There shall be no direct compensation for cutting off timber, steel, precast concrete or prestressed concrete piles and shells for cast-in-place concrete piles as ordered; but the cost thereof shall be considered as included in the cost of the pile items.

10. Point Reinforcement for Piles: Authorized points for pointing and reinforcing piles will be paid for at the contract unit price each for "Point Reinforcement for Timber Piles," or "Point Reinforcement for Steel Piles," respectively, whichever applies, which price shall include all materials, equipment, tools and labor incidental thereto. In the absence of such prices, authorized points will be paid for as extra work.

11. Pre-Augering of Piles: Payment for "Pre-Augering of Piles" will be at the contract unit price per linear foot (meter) for "Pre-Augering of Piles," which price shall include which price shall include all materials, and all equipment, tools and labor incidental thereto.

12. Underground Obstructions: If the required pile penetration is not reached due to the presence of underground obstructions which are not the result of the Contractor's operations but are due to the presence of earlier construction at the site, then the cost of removing these obstructions and back-filling the area will be paid for as extra work unless otherwise specified in the contract documents.

13. Painting: There will be no additional payment for painting steel piles and steel pile shells, but the cost thereof shall be considered as included in the cost of furnishing and driving the piles.

14. Disposal of Pile Cutoffs: All costs incidental to the disposal of cutoff material will be included in the price of furnishing of the type of pile specified.

Pay Item	Pay Unit
Furnishing (Type) Piles (Lengths)	lb. (kg)
Driving (Type) Piles	l.f. (m)
Test Pile (Type-Length)	ea. (ea.)
Splicing (Type) Piles	ea. (ea.)
Point Reinforcement for (Type) Piles	ea. (ea.)
Pile Loading Test	ea. (ea.)
Dynamic Pile Driving Analysis (PDA) Test	ea. (ea.)
Pre-Augering of Piles	l.f. (m)

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 7.06
MICROPILES**

Add the following section:

**SECTION 7.06
MICROPILES**

- 7.06.01 – Description**
- 7.06.02 – Materials**
- 7.06.03 – Construction Methods**
- 7.06.04 – Method of Measurement**
- 7.06.05 – Basis of Payment**

7.06.01 - Description: This work shall consist of constructing micropiles in accordance with the Contract. The Contractor is responsible for furnishing all design, materials, products, accessories, tools, equipment, services, transportation, labor and supervision required for design, installation and testing of micropiles and micropile top attachments for this Project.

The Contractor shall select the micropile type, size, pile-top attachment, installation means and methods, and shall estimate the grout-to-ground bond value(s) and determine the required grout bond length and final micropile diameter.

The Contractor shall design and install micropiles that will develop the load capacities indicated on the plans. The micropile load capacities shall be confirmed by verification and proof-load testing as required and must meet the test acceptance criteria specified herein. The Contractor's micropile design shall conform to requirements set forth in this specification and to micropile design minimums/maximums shown on the Contract drawings.

7.06.02 - Materials: Furnish new materials without defects. Materials for micropiles shall comply with the following:

- 1. Admixtures for Grout:** Admixtures shall comply with Article M.03.01 hereof. Accelerators are not permitted. Expansive admixtures and admixtures containing chlorides are not permitted.
- 2. Cement:** Cement shall conform to ASTM C 150/AASHTO M85, Types II, III or V.
- 3. Centralizers and Spacers:** Centralizers and spacers shall be fabricated from Schedule 40 PVC pipe.
- 4. Grout:** Grout shall consist of neat cement or fine aggregate/cement mixture meeting the three (3) and twenty-eight-(28-)day required compressive strengths specified in the Contract. The grout shall conform to AASHTO T106/ASTM C109 and to any minimum and

maximum properties shown on the plans or in Article M.03.05.

- 5. Permanent Casing Pipe:** Permanent steel casing or steel pipe shall conform to required minimum and maximum properties shown on the plans. The steel casing or steel pipe shall comply with one or more of the following specifications: ASTM A252 or A106, or API N-80.
- 6. Reinforcing Bars:** Reinforcing steel shall be deformed bars in accordance with ASTM A615/AASHTO M31. Continuous spiral deformations (*i.e.*, continuous thread bars) shall be used for same. Bar tendon couplers, if required, shall develop the ultimate tensile strength of the bars without evidence of any failure.
- 7. Encapsulation:** Encapsulation (double corrosion protection) shall be shop-fabricated using high-density, corrugated polyethylene tubing complying with the requirements of ASTM D3350/AASHTO M252 with a nominal wall thickness of 0.03 in (0.8 mm). The inside annulus between the reinforcing bar(s) and the encapsulation tube shall measure a minimum 0.2 in (5 mm) and be fully grouted with non-shrink grout conforming to Section M.03.

7.06.03 - Construction Methods:

- 1. Contractor's Experience Requirements:** The micropile Contractor shall be experienced in the construction and load testing of micropiles, having successfully constructed at least five (5) projects in the last five (5) years involving construction totaling at least one hundred (100) micropiles of capacity similar to that required of the ones in these plans and Specifications.

The Contractor shall have previous micropile drilling and grouting experience in soil/rock conditions similar to those on this Project. The Contractor shall submit construction details, structural details and load test results for at least three (3) previous successful micropile load tests from different projects similar in scope to this Project.

The Contractor shall assign or hire a professional engineer, licensed in the State of Connecticut, to supervise the micropile work. That engineer shall have experience on at least ten (10) projects of similar scope to this Project, completed over the past five (5) years. The Contractor shall not use manufacturers' representatives to satisfy the supervising engineer requirements of this Section. The Contractor may use a single independent consultant for this purpose, provided that the consultant has specific experience as described above and operates specifically for the purpose of transferring technology and skills in micropiling to contractors. The on-Site foremen and drill rig operators shall also have experience on at least ten (10) projects over the past five (5) years installing micropiles of equal or greater capacity than is required in these plans and Specifications.

The Contractor shall assign or hire a professional engineer, licensed in the State of Connecticut, to design the micropiles. This engineer shall have experience in the design of at least three (3) successfully-completed micropile projects over the past five (5) years, with micropiles of capacity similar to that required in these plans and specifications. This engineer shall also be responsible for design, supervision and reporting of the verification and proof test(s).

At least forty-five (45) calendar days before the planned start of micropile construction, the Contractor shall submit five (5) copies of the completed Project reference list and a personnel list. The Project reference list shall include a brief Project description with the owner's name and current phone number and load test reports. The personnel list shall identify the supervising Project Engineer, drill rig operators, and on-Site foremen to be assigned to this Project by the Contractor. The personnel list shall contain a summary of each individual's experience and be complete enough for the Engineer to determine whether each individual has the required qualifications.

Work shall not start, nor materials be ordered, until the Engineer gives written approval of the Contractor's experience qualifications. The Engineer may suspend work if the Contractor uses non-approved personnel on the Project. If work is suspended for that reason, the Contractor shall be fully liable for all resulting costs, and Department will not make any Contract time adjustments because of the suspension.

2. Micropile Design Requirements and Submittals: The micropiles shall be designed to meet the specific loading conditions, as shown on the plans and approved working drawings. The micropile design shall conform to all required minimum and maximum properties shown on the plans, the "American Association of State Highway and Transportation Officials (AASHTO) LRFD Bridge Design Specifications" (including the latest Interims), and the "Connecticut Department of Transportation Bridge Design Manual."

Where called for on the plans, the Contractor shall provide corrosion protection of the internal steel reinforcing bars, consisting of encapsulation, epoxy coating or grout. Where the permanent casing is used for a portion of the micropile, the corrosion protection shall extend at least 5 ft (1.5 m) into the casing. Steel pipe used for micropile permanent casing shall incorporate an additional 1/16 in (1.6 mm) thickness of sacrificial steel for corrosion protection.

The Contractor shall submit working drawings in accordance with Section 1.05 to the Engineer. The working drawings shall include all information required for the design, plans, construction and quality control of the micropile installation. The information shall include, but not necessarily be limited to, the following;

(a) Design Computations

- I. A written summary report describing the overall micropile design.
- II. A statement of applicable code requirements and design references.
- III. Micropile structure critical design cross-section(s) geometry, including soil/rock strata and piezometric levels and location, magnitude and direction of applied loadings, including slope or external surcharge loads.
- IV. A description of design criteria to be applied to the work, including, soil/rock shear strengths (friction angle and cohesion), unit weights, and grout-to-ground bond value(s) and micropile drill-hole diameter assumptions for each soil/rock stratum.
- V. A statement of Resistance/Load factors used in the design of the grout-to-ground

bond value(s), surcharges, soil/rock and material unit weights, steel, grout and concrete materials.

- VI. Design calculation sheets with the Project number, micropile structure location, designation, date of preparation, initials of designer and checker, and page number at the top of each page. Provide an index page for the design calculations.
- VII. Design notes including a list of symbols and computer program used in the design.
- VII. Pile-to-footing connection calculations.

(b) Plans

- I. A plan view of the micropile structures providing:
 - i. A reference baseline and elevation datum.
 - ii. The offset from the construction centerline or baseline to the face of the micropile structure at all changes in horizontal alignment.
 - iii. Beginning and end of micropile structure stations.
 - iv. Right-of-way and permanent or temporary construction easement limits, location of all known active and abandoned utilities, adjacent structures or other potential interference; and the centerline of any drainage structure or drainage pipe behind, passing through or passing under the micropile structure.
 - v. Subsurface exploration locations shown on the plan view of the proposed micropile structure alignment with appropriate reference baselines to fix the locations of the exploration relative to the micropile structure.
- II. An elevation view of the micropile structure(s) providing:
 - i. Elevation view showing micropile locations and elevations; vertical and horizontal spacing; batter and alignment and the location of drainage elements (if applicable).
 - ii. Existing and finished grade profiles both behind and in front of the micropile structure.
- III. Design parameters and applicable codes.
- IV. General notes for constructing the micropile structure, including construction sequencing or other special construction requirements.
- V. Horizontal and vertical curve data affecting the micropile structure and micropile structure control points. Match lines or other details to relate micropile structure stationing to centerline stationing.
- VI. A listing of the summary of quantities on the elevation drawing of each micropile structure, showing pay item estimated quantities.

- VII. Micropile typical sections, including micropile spacing and inclination; minimum drill-hole diameter; pipe casing and reinforcing bar size and details; splice type and locations; centralizers and spacers; grout bond zone and casing plunge length (if used); corrosion protection details; and connection details to the substructure footing, anchorages and plates.
- VIII. A typical detail of verification and production proof test micropiles defining the micropile length, minimum drill-hole diameter, inclination, and load test bonded and unbonded test lengths.
- IX. Details, dimensions and schedules for all micropiles, casing and reinforcing steel, including reinforcing bar bending details.
- X. Details for constructing micropile structures around drainage facilities (if applicable).

(c) Construction Procedures

- I. Detailed step-by-step description of the proposed micropile construction procedure, including personnel, testing and equipment to ensure quality control. This step-by-step procedure shall be shown in sufficient detail to allow the Engineer to monitor the construction and quality of the micropiles.
- II. Proposed start date, time schedule and micropile installation schedule providing the following:
 - i. Micropile number.
 - ii. Micropile design load.
 - iii. Type and size of rebar.
 - iv. Minimum total bond length.
 - v. Total micropile length.
 - vi. Micropile top footing attachment.
- III. If welding of casing is proposed, submit the welding procedure. All welding shall be done in accordance with the current AWS Structural Welding Code.
- IV. Information on space requirements for installation equipment that verify the proposed equipment can perform at the Site.
- V. Proposed plan describing how surface water, drill flush, and excess waste grout will be controlled and disposed. This will include computations showing that the proposed equipment used for flushing the micropile during installation (*i.e.*, pumps for water flushing and compressors for air flushing) will maintain up-hole (flushing) velocities necessary to ensure that all of the flush and drill cuttings are returned up through the annulus between the drill rod and casing.

- VI. Certified mill test reports for the reinforcing steel and for permanent casing. The ultimate strength, yield strength, elongation, and material properties composition shall be included. For API N-80 pipe casing, coupon test results may be submitted in lieu of mill certification.
- VII. Proposed Grouting Plan. The grouting plan shall include complete descriptions, and details for the following:
- a. Grout mix design and type of materials to be used in the grout, including certified test data and trial batch reports. The Contractor shall also provide specific gravity of the wet mix design.
 - b. Methods and equipment for accurately monitoring and recording the grout depth and grout volume as the grout is being placed.
 - c. Estimated curing time for grout to achieve specified strength. Previous test results for the proposed grout mix completed within one (1) year of the start of grouting may be submitted for initial verification and acceptance and start of production work. During production, grout shall be tested in accordance with Article M.03.05.
 - d. Procedure and equipment for Contractor monitoring of grout quality. At a minimum, the Contractor shall be required to use a Baroid Mud Balance (per API RP-13B-1) to check the specific gravity of the mixed grout prior to placement into each drilled micropile.
- (d) Detailed plans for the proposed micropile load testing method. This shall include all drawings, details, and structural design calculations necessary to clearly describe the proposed test method, reaction load system capacity and equipment setup, types and accuracy of apparatus to be used for applying and measuring the test loads and pile top movements in accordance with this Specification.
- (e) Calibration reports and data for each test jack, pressure gauge and master pressure gauge and electronic load cell to be used. The calibration tests shall have been performed by an independent testing laboratory within ninety (90) calendar days of the date submitted. Testing shall not commence until the Engineer has reviewed and accepted the jack, pressure gauge, master pressure gauge and electronic load cell calibration data.

Work shall not begin until the construction submittals have been received, reviewed, and accepted in writing by the Engineer. Any submittals found to be unacceptable by the Engineer shall be revised, resubmitted and accepted prior to commencing work.

- 3. Pre-construction Meeting:** A pre-construction meeting will be scheduled by the Engineer and held prior to the start of micropile construction. The Engineer, prime Contractor, micropile specialty Contractor and micropile design engineer shall attend the meeting. Attendance is mandatory. The pre-construction meeting will be conducted in order to clarify the construction requirements for the work, to coordinate the construction schedule and activities, and to identify contractual relationships and delineation of responsibilities among the prime Contractor and the various subcontractors - specifically those pertaining to

excavation for micropile structures, installation of temporary sheeting, anticipated subsurface conditions, micropile installation and testing, micropile structure survey control and Site drainage control.

- 4. Site Drainage Control:** The Contractor shall control and properly dispose of drill flush and construction related waste, including excess grout, in accordance with Section 1.10, any related Special Provisions in the Contract, and all applicable codes and regulations. Drill flush shall be conveyed by pipe, hose or conduit away from the location where the micropile is being drilled and away from any adjacent structure or facility. The Engineer will determine the acceptable distance required to convey the drill flush away from the micropile location. The Contractor shall provide positive control and discharge of all surface water that will affect construction of the micropile installation; maintain all pipes or conduits used to control surface water during construction; and repair any damage caused by surface water at no additional cost to the Department. Upon substantial completion of the work, the Contractor shall remove surface water control pipes or conduits from the Site. Alternatively, with the approval of the Engineer, the Contractor may leave pipes or conduits in place if fully grouted.

The Contractor shall immediately contact the Engineer if unanticipated existing subsurface drainage structures or other utilities are discovered during excavation or drilling; and shall suspend work in such areas until remedial measures meeting the Engineer's approval are implemented.

5. Micropile Allowable Construction Tolerances:

- (a) Centerline of piling shall not be more than 3 in (75 mm) from indicated plan location. Centerline of reinforcing steel shall not be more than 0.5 in (13 mm) from the centerline of the pile.
- (b) Pile shall be plum or battered within two percent (2%) of total-length plan alignment.
- (c) Top elevation of pile shall be plus 1 in (25 mm) or minus 1 in (25 mm) maximum from vertical elevation indicated.

- 6. Micropile Installation:** The micropile Contractor shall select the drilling method, the grouting procedure and the grouting pressure used for installation of the micropiles. The micropile Contractor shall also determine the micropile casing size, final drill-hole diameter and bond length, and central tendon reinforcement steel size necessary to develop the specified load capacities and load testing requirements. All micropile material properties and dimensions shall conform to minimum/maximum properties and dimensions as shown in the Contract drawings. The micropile Contractor is also responsible for estimating the grout take. The Department will make no extra payment for grout overruns.

Should the plans require uncased drilling of the micropile into bedrock, the permanent or temporary casing shall be drilled a minimum 6 in (150 mm) into ledge or to a depth within the ledge so as to prevent subsidence of overburden into the uncased and bonded zone portion of the drill-hole (*i.e.*, the rock socket). The plans show estimated permanent casing lengths for each substructure unit. Any difference in the required length of permanent casing accepted by the Engineer from the estimated lengths shown on the plans shall be

measured for payment and credit. The Department will make no payment for differences in required length of temporary casing.

The drilling equipment and methods shall be suitable for drilling through the conditions to be encountered, without causing damage to the overburden, any overlying or adjacent structures, buried structures, utilities or services. If called for in the drilling method description, or by the nature of the stratum to be drilled through, the micropile Contractor shall furnish an overburden casing of the type and thickness that can be installed without distortion. Casings that fail, fracture, or otherwise distort during drilling or after drilling shall, unless otherwise directed, be withdrawn or replaced at the micropile Contractor's expense. The drill-hole must be open along its full length to at least the design minimum drill-hole diameter prior to placing grout and reinforcement.

Temporary casing or other approved method of pile drill-hole support will be required in caving or unstable ground in order to permit the pile shaft to form a drill hole of the minimum design diameter. The Contractor's proposed method(s) to provide drill-hole support and to prevent detrimental ground movements must be reviewed by the Engineer in advance of its use. Detrimental ground movement is defined as movement that requires remedial repair measures, in order to maintain Site conditions as determined by the Engineer.

Drilling and flushing methods shall be selected by the Contractor. Use of drilling fluid containing bentonite or any other non-reverting drilling fluid, however, is not allowed. The drilling and flushing system chosen by the Contractor shall be capable of providing the necessary up-hole velocity so as to ensure that all the flush and drill cuttings are returned up through the annulus between the drill rod and casing. The flush must not be allowed to escape in an uncontrollable fashion into the soil and rock formations outside the casing. The return flush must never be blocked or suppressed within the casing on its way back to the surface. The Contractor shall monitor and modify, as needed, the flush velocity and other elements of its drilling methods that could contribute to return of flush outside the casing. When return of flush is substantially lost during drilling, the Contractor shall halt drilling operations and immediately notify the Engineer of the situation.

During construction, the Contractor shall observe the ground conditions in the vicinity of the micropile construction site on a daily basis for signs of ground heave or subsidence, and must immediately notify the Engineer if signs of movements are observed. The micropile Contractor shall immediately suspend or modify drilling or grouting operations if ground heave or subsidence is observed, if the micropile structure is adversely affected, or if adjacent structures are damaged because of the drilling or grouting. If the Engineer determines that the movements require corrective action, the micropile Contractor shall take corrective actions necessary to stop the movement or perform repairs.

Reinforcement may be placed prior to grouting the drill-hole. Reinforcement surface shall be free of deleterious substances such as soil, mud, grease or oil that might contaminate the grout or coat the reinforcement and impair bond. Pile reinforcement groups, if used, shall be sufficiently strong to withstand the installation and grouting process without damage or disturbance.

The micropile Contractor shall check pile-top elevations and adjust all installed micropiles to the planned elevations.

Centralizers and spacers shall be provided at 10 ft (3 m) on center maximum spacing. The uppermost and lowest centralizers shall be located a maximum of 3 ft (0.9 m) from the top and bottom of the micropile. Centralizers and spacers shall be securely attached to the reinforcement, sized to position the reinforcement within 1/2 in (12 mm) of plan location from center of pile, sized to allow grout tremie pipe insertion to the bottom of the drill-hole, and must be of sufficient size to allow grout to flow freely up the drill-hole, up the casing, and between adjacent reinforcing bars. The reinforcing steel shall be inserted into the drill-hole to the desired depth without difficulty. Partially inserted reinforcing bars shall not be driven or forced into the hole. The micropile Contractor shall re-drill and reinsert reinforcing steel when necessary in order to facilitate insertion.

Lengths of casing and reinforcing bars to be spliced shall be secured in proper alignment and in a manner that prevents eccentricity or an angle between the axes of the lengths to be spliced. Splices and threaded joints shall meet the requirements of the rebar material. Threaded pipe casing joints shall be located at least two (2) casing diameters (OD) from a splice in any reinforcing bar. When multiple bars are used, bar splices shall be staggered at least 1 ft (0.3 m).

Micropiles shall be grouted on the same day that the load transfer bond length is drilled. The grouting equipment used shall be a colloidal grout plant and shall produce a grout free of lumps and undispersed cement. Paddle type mixers are not acceptable. The micropile Contractor shall have means and methods of measuring the grout quantity and pumping pressures during the grouting operations. The grout pump shall be equipped with a pressure gauge to monitor grout pressure. A second pressure gauge shall be placed at the point of injection into the pile top. The pressure gauge shall be capable of measuring pressures of at least 145 psi (1000 kPa) or two (2) times the actual grout pressure used, whichever is greater. The grout shall be kept in agitation prior to mixing. Grout shall be placed within one (1) hour of mixing. The grouting equipment shall be sized to enable each pile to be grouted in one continuous operation. The grout shall be injected from the lowest point of the drill-hole, and injection shall continue until uncontaminated grout flows from the top of the pile. The grout may be pumped through grout tubes, casing, hollow stem augers or drill rods. Temporary casing, if used, shall be extracted in stages so as to ensure that, after each length of casing is removed, the grout level is brought back up to the ground level before the next length is removed. The tremie pipe or casing shall always extend below the level of the existing grout in the drill-hole. The grout takes shall be controlled to prevent excessive heave or fracturing of rock or soil formations. Upon completion of grouting, the grout tube may remain in the hole, but must be filled with grout.

If the Contractor elects to use a post-grouting system, working drawings and details shall be submitted to the Engineer for review in accordance with Section 1.05.

Grout within the micropile verification and proof test piles shall attain the minimum required three-(3-)day compressive strength prior to load testing. During production, micropile grout shall be tested by the Contractor for compressive strength in accordance with AASHTO T106/ASTM C109 at a frequency of no less than one (1) set of three (3) each 2 in (50 mm) grout cubes, or 3 in (75 mm) cylinders, from each grout plant each day of operation, or per every ten (10) micropiles, whichever occurs more frequently. The compressive strength shall be the average of the three (3) cubes or cylinders tested.

Grout consistency as measured by grout density shall be determined by the micropile Contractor per API RP-13B-1 at a frequency of at least one (1) test per pile, conducted just prior to start of pile grouting. The Baroid Mud Balance used in accordance with API RP-13B-1 is an approved device for determining the grout density of neat cement grout.

Provide grout cube or cylinder compressive strength and grout density test results to the Engineer within twenty-four (24) hours of testing.

- 7. Micropile Installation Records:** The micropile Contractor shall prepare and submit to the Engineer full-length installation records for each micropile installed. The records shall be submitted within one (1) work shift after that pile installation is completed. The data shall be recorded on a micropile installation log. A separate log shall be provided for each micropile.
- 8. Verification and Proof Tests:** The Contractor shall perform verification and proof testing of piles at the locations specified on the plans, and perform compression load testing in accord with ASTM D1143 and tension load testing in accord with ASTM D3689, except as modified herein. If the Contractor designs micropiles using tip resistance, it shall use ASTM 1143 for verification and proof tests thereof.

The Contractor shall perform pre-production verification pile load test(s) to verify the design of the pile system and the construction methods proposed prior to installing any production piles. Sacrificial verification test pile(s) shall be constructed by the Contractor in conformance with the approved working drawings, and shall install verification test pile(s) at the location(s) shown on the plans or at location(s) approved by the Engineer.

Verification load test(s) shall be performed in order to verify that the micropiles installed by the Contractor will meet the compression and tensile load capacities and load test acceptance criteria, and to verify that the length of the micropile load transfer bond zone is adequate. The micropile verification load test results must verify the Contractor's design and installation methods.

The drilling method, grouting method, permanent casing length, micropile diameter (cased and uncased) and bond zone length for the verification test pile shall be identical to those specified for the production piles at the given locations. The verification test micropile structural steel sections shall be sized to safely resist the maximum test load.

The maximum verification and proof test loads applied to the micropile shall not exceed eighty percent (80%) of the structural capacity of the micropile structural elements, including steel yield in tension, steel yield or buckling in compression, or grout crushing in compression. Any required increase in strength of the verification and proof test pile elements above the strength required for the production piles shall be provided for in the Contractor's bid price.

Testing equipment used in connection with the micropiles shall include dial gauges, dial gauge independent reference frame, jack and pressure gauge, electronic load cell (with readout device), and a reaction frame. The load cell is required only for the creep test portion of the verification test. The Contractor shall provide a description of test setup and jack, pressure gauge and load cell calibration curves as outlined in the Submittals Section.

The Contractor shall design the testing reaction frame to be sufficiently rigid and of adequate dimensions to ensure that excessive deformation of the testing equipment does not occur; and must align the jack, bearing plates, and stressing anchorage so that unloading and repositioning of the equipment will not be required during the test.

The Contractor shall also apply and measure the test load with a hydraulic jack and pressure gauge. The pressure gauge shall be graduated in 100 psi (690 kPa) increments or less. The jack and pressure gauge shall have a pressure range not exceeding twice the anticipated maximum test pressure. Jack ram travel shall be sufficient to allow the test to be done without resetting the equipment. The Contractor shall monitor the creep-test-load-hold during verification tests with both the pressure gauge and the electronic load cell; and shall use the load cell in order to accurately maintain a constant load hold during the creep-test-load-hold increment of the verification test.

The Contractor shall measure the pile top movement with a dial gauge capable of measuring to 0.001 in (0.025 mm). The dial gauge shall have a travel sufficient to allow the test to be done without having to reset the gauge; and the Contractor shall visually align the gauge to be parallel with the axis of the micropile and support the gauge independently from the jack, pile or reaction frame. The Contractor shall also use a minimum of two (2) dial gauges when the test setup requires reaction against the ground or single reaction piles on each side of the test pile.

The Contractor shall test verification piles to the following loads: Alignment Load ("AL"), Maximum Service Limit Pile Load ("SVL") and the Ultimate Pile Capacity ("UPC"). The SVL and UPC loads are provided on the Contract drawings. The AL is the minimum load applied to the micropile during testing needed to keep the testing equipment correctly positioned. The AL shall not exceed five percent (5%) of the SVL. The verification pile load tests shall be made by incrementally loading the micropile in accordance with the cyclic load schedule shown in Table 7.06-1, for both compression and tension loading (test the compression prior to tension).

Table 7.06-1, Cyclic Load Schedule for Verification Pile Load Test

Step	Loading	Applied Load	Hold Time (minutes)
1	Apply AL	AL	2.5
2	Cycle 1	0.15 SVL	2.5
		0.30 SVL	2.5
		0.45 SVL	2.5
		0.60 SVL	2.5
		0.75 SVL	2.5
		0.90 SVL	2.5
		1.00 SVL	10 to 60 minutes
		0.60 SVL	2.5
		0.30 SVL	2.5
		AL	
3	Cycle 2	0.075 UPC	2.5
		0.150 UPC	2.5
		0.225 UPC	2.5
		0.300 UPC	2.5
		0.375 UPC	2.5
		0.450 UPC	2.5
		0.525 UPC	2.5
		0.600 UPC	2.5
		0.675 UPC	2.5
		0.750 UPC	2.5
		0.825 UPC	2.5
		0.900 UPC	2.5
		1.000 UPC	10 to 60 minutes
		0.750 UPC	2.5
		0.525 UPC	2.5
		0.225 UPC	2.5
		AL	

Pile-top movement shall be measured at each load increment. The load-hold period shall start as soon as each test load increment is applied. Pile movement during the 1.00 SVL and 1.000 UPC loads shall be measured and recorded at 1,2,3, 4, 5, 6, 10, 20, 30, 50, and sixty (60) minutes. The alignment load shall not exceed five percent (5%) of the SVL. Dial gauges shall be reset to zero after the initial AL is applied.

The acceptance criteria for micropile verification load test are:

- (a) The Engineer shall determine the criteria for tolerable movement during the load test at the top of the micropile.
- (b) At the end of the maximum test load increment for each cycle, test piles shall have a creep rate not exceeding 0.05 in (1.3 mm) /log cycle time (1 to 10 minutes) or 0.1 in (2.5 mm) /log cycle time (6 to 60 minutes or the last log cycle if held longer). The creep rate shall be linear or decreasing throughout the hold period.

- (c) Failure does not occur at any load increment up to and including the maximum test load for each cycle. Failure is defined as load at which attempts to further increase the test load simply result in continued pile movement.

Upon completion of the test, the Contractor shall prepare and submit a report of the test results, stamped by a professional engineer, for review and acceptance by the Engineer prior to beginning installation of production micropiles. This report shall include written confirmation of the verification micropile's capacity.

If a verification tested micropile fails to meet the acceptance criteria, the Contractor shall modify the design, the construction procedure, or both. These modifications may include modifying the installation methods, increasing the bond length, or changing the micropile type. Any modification that necessitates changes of the structure shall be submitted as a revision to the working drawings and require the Engineer's review and acceptance. Any modifications of design or construction procedures or cost of additional verification test piles and load testing shall be at the Contractor's expense. At the completion of verification testing, the Contractor shall remove test piles down to the elevation specified by the Engineer.

The Contractor shall perform proof load tests at the micropile locations as shown on the plans, and shall perform proof-load tests on the first set of production piles installed at each designated substructure unit prior to the installation of the remaining production piles in that unit. The initial proof-test piles shall be installed at the locations shown on the plans. Upon completion of each test, the Contractor shall prepare and submit a report of the test results, stamped by a professional engineer, for review and acceptance by the Engineer

The Contractor shall test proof test piles to a maximum test load of 1.00 times the Maximum Strength Limit Pile Load (STL). The STL load is provided on the Contract drawings. Proof tests shall be made by incrementally loading the micropile as shown in Table 7.06-2, to be used for both compression and tension loading:

Table 7.06-2, Incremental Loading for Proof Test Piles

Step	Loading	Applied Load	Hold Time (minutes)
1	Apply AL		2.5
2	Cycle 1	0.15 STL	2.5
		0.30 STL	2.5
		0.45 STL	2.5
		0.60 STL	2.5
		0.75 STL	2.5
		0.90 STL	2.5
		1.00 STL	10 to 60 minutes
		0.60 STL	2.5
		0.30 STL	2.5
		AL	

Depending on performance, either a ten-(10-)minute or sixty-(60-)minute creep test shall be performed at the 1.00 STL test load. Where the pile top movement between one (1) and then (10) minutes exceeds 0.039 in (1 mm), the Maximum Test Load shall be

maintained an additional fifty (50) minutes. Movements shall be recorded at 1, 2, 3, 5, 6, 10, 20, 30, 50 and 60 minutes. The alignment load shall not exceed five percent (5%) of STL. Dial gauges shall be reset to zero after the initial AL is applied.

The acceptance criteria for micropile proof load tests are:

- (a) The Engineer shall determine the criteria for tolerable movement during the load test at the top of the micropile.
- (b) At the end of the 1.00 STL test load increment, test piles shall have a creep rate not exceeding 0.05 in (1.3 mm) /log cycle time (1 to 10 minutes) or 0.1 in (2.5 mm) /log cycle time (6 to 60 minutes). The creep rate shall be linear or decreasing throughout the creep-load hold period.
- (c) Failure does not occur at the 1.00 STL maximum test load. Failure is defined as the load at which attempts to further increase the test load simply result in continued pile movement.

If a proof-tested micropile fails to meet the acceptance criteria, the Contractor shall immediately proof test another micropile within that footing. For failed piles and further construction of other piles, the Contractor shall modify the design, the construction procedure, or both. These modifications may include installing replacement micropiles, incorporating piles at not more than fifty percent (50%) of the maximum load attained, post-grouting the tested pile and re-proof testing the pile, modifying installation methods, increasing the bond length, or changing the micropile type. Any modification that necessitates changes of the structure design shall require the Engineer's prior review and acceptance. Any modifications of design or construction procedures, or cost of additional verification test piles and verification or proof load testing, or replacement production micropiles, shall be at the Contractor's expense.

7.06.04 - Method of Measurement:

- 1. Micropiles** will be measured for payment by the number of micropiles installed and accepted. There will be no separate measurement or payment for furnishing the design of the micropiles or developing installation methods to meet these Specifications.
- 2. Verification Test for Micropiles** will be measured for payment by the number of verification tests performed on sacrificial micropiles.
- 3. Proof Test for Micropiles** will be measured for payment by the number of proof tests performed on production micropiles.
- 4. Micropile Length Adjustment** will be measured for payment by the length in linear feet (meter) of the difference between the estimated length of permanent casing, as shown on the plans, and the actual length of permanent casing installed and accepted by the Engineer. (Note that the permanent casing length is measured from the bottom of the pile cap to the permanent casing tip, including the required embedment of casing into rock. Embedment into the pile cap will not be measured for payment because it is considered incidental to micropile construction. Any increase in casing length will be measured for

payment to the Contractor, and any decrease in casing length will be measured for credit to the State.)

There will be no separate measurement or payment for mobilization and demobilization associated with this item.

7.06.05 - Basis of Payment:

- 1. Micropiles** will be paid for at the Contract unit price each for “Micropiles” complete and accepted in place, including all design, development of installation methods, materials, equipment, tools, proper disposal of drilling spoil and labor incidental thereto.
- 2. Verification Test for Micropiles** will be paid for at the Contract unit price each for “Verification Test for Micropiles” completed on sacrificial micropiles, including all materials, testing equipment, tools, test reports, removal of test piles and labor incidental thereto.
- 3. Proof Test for Micropiles** will be paid for at the Contract unit price each for “Proof Test for Micropiles” completed on production micropiles, including all materials, testing equipment, tools, test reports and labor incidental thereto.
- 4. Micropile Length Adjustment** will be paid for at the Contract unit price per linear foot (meter) for “Micropile Length Adjustment” complete and accepted, including all materials, equipment, tools, and labor incidental thereto.

Pay Item	Pay Unit
Micropiles	ea. (ea.)
Verification Test for Micropiles	ea. (ea.)
Proof Test for Micropiles	ea. (ea.)
Micropile Length Adjustment	l.f. (m)

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 8.22
TEMPORARY PRECAST CONCRETE BARRIER CURB**

8.22.02 – Materials:

In the second sentence of the third paragraph, change “reflective” to “retroreflective.”

8.22.04 – Method of Measurement:

Add the following sentence to the end of the second paragraph:

“Relocation of Temporary Precast Concrete Barrier Curb for access to the work area or for the convenience of the Contractor shall be considered incidental to Maintenance and Protection of Traffic and will not be measured for payment.”

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 9.10
METAL BEAM RAIL**

9.10.02 – Materials:

Change Subarticles 1 and 2 as follows:

- “ 1. Chemical anchoring material shall meet the requirements of Article M.03.07.
2. Metal beam rail delineators shall meet the requirements of Article M.18.09 and Article M.18.13.”

9.10.04 – Method of Measurement:

1 – Metal Beam Rail (Type)

Delete the only sentence and replace with the following:

“The length of metal beam rail measured for payment will be the number of linear feet (meters) of accepted rail of the type or designation installed, including radius rail other than Curved Guide Rail Treatment, measured along the top of rail between centers of end posts in each continuous section.”

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 9.18
THREE CABLE GUIDE RAILING
(I-BEAM POSTS) AND ANCHORAGES**

9.18.02—Materials:

In the second sentence of the only paragraph, change “reflective” to “retroreflective.”

9.18.03 – Construction Methods:

In the 10th paragraph, replace “MIL” with “MILSPEC.”

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 9.21
CONCRETE SIDEWALKS**

Delete the entire Section and replace with the following:

**SECTION 9.21
CONCRETE SIDEWALKS AND RAMPS**

9.21.01—Description

9.21.02—Materials

9.21.03—Construction Methods

9.21.04—Method of Measurement

9.21.05—Basis of Payment

9.21.01—Description: This item shall consist of concrete sidewalks and ramps constructed on a gravel or reclaimed miscellaneous aggregate base course in the locations and to the dimensions and details shown on the plans or as ordered and in accordance with these specifications.

9.21.02—Materials: Materials for this work shall conform to the requirements of Article M.03.01 for Class “F” Concrete.

Gravel or reclaimed miscellaneous aggregate for base shall conform to Article M.02.01 for granular fill.

Detectable warning strips shall be prefabricated detectable warning tile chosen from the Department’s Qualified Products List for retrofit or cast in place applications.

9.21.03—Construction Methods:

1. Excavation: Excavation, including removal of any existing sidewalk (bituminous or concrete) and curbing, shall be made to the required depths below the finished grade, as shown on the plans or as directed. All soft and yielding material shall be removed and replaced with suitable material.

When connecting new concrete sidewalk to a section of existing concrete sidewalk, the connection point shall be at the nearest joint in the existing sidewalk.

The Contractor shall establish the limits required to achieve grades for each ramp prior to removal of existing sidewalk and ramps. The Contractor shall document and notify the Engineer of any control points that may conflict with the design grades or configuration of ramps shown on the plans. Control points can be but are not limited to ROW, utility poles, drainage structures, buildings, fences, walls or other features found near the proposed ramp. When control points are encountered within the limits of the ramp, the Engineer will determine if an alternative ramp type is required or the ramp is to be constructed as shown on the plans.

2. Gravel or Reclaimed Miscellaneous Aggregate Base: The gravel or reclaimed miscellaneous aggregate base shall be placed in layers not to exceed 6 inches in depth and to such a depth that after compaction it shall be at the specified depth below the

finished grade of the walk. The base shall be wetted and rolled or tamped after the spreading of each layer.

3. Forms: Forms shall be of metal or wood, straight, free from warp and of sufficient strength to resist springing from the pressure of the concrete. If made of wood, they shall be of 2-inch surfaced plank except that at sharp curves thinner material may be used. If made of metal, they shall be of an approved section and have a flat surface on the top. Forms shall be of a depth equal to the depth of the sidewalk. Forms shall be securely staked, braced and held firmly to the required line and grade and shall be sufficiently tight to prevent leakage of mortar. All forms shall be cleaned and oiled or wetted before concrete is placed against them. Sheet metal templates 1/8 inch in thickness, of the full depth and width of the walk, shall be spaced at intervals of 12 feet or as directed. If the concrete is placed in alternate sections, these templates shall remain in place until concrete has been placed on both sides of the template. As soon as the concrete has obtained its initial set, the templates shall be removed.

4. Concrete: The concrete shall be proportioned, mixed, placed, etc., in accordance with the provisions of Section 6.01 for Class "F" Concrete. Concrete shall be cured in accordance with the provisions of Article 4.01.03 for Concrete Pavement.

5. Finishing: The surface of the concrete shall be finished with a wood float or by other approved means. The outside edges of the slab and all joints shall be edged with a 1/4-inch radius edging tool. Each slab shall be divided into two or more sections by forming dummy joints with a jointing tool as directed.

6. Backfilling and Removal of Surplus Material: The sides of the sidewalk shall be backfilled with suitable material thoroughly compacted and finished flush with the top of the sidewalk. All surplus material shall be removed and the site left in a neat and presentable condition to the satisfaction of the Engineer.

7. Detectable Warning Strip: The detectable warning strip for new construction shall be set directly in poured concrete and each tile shall be weighed down to prevent the tile from floating after placement in wet concrete in accordance with curing procedures. Install detectable warning strip, according to the plans and the manufacturer's specifications, or as directed by the Engineer.

The detectable warning strip for retrofit construction shall be installed according to the plans in the direction of pedestrian route and contained wholly within painted crosswalk when present. Its installation shall conform to all manufacturer's requirements.

9.21.04—Method of Measurement: This work will be measured for payment as follows:

1. Concrete Sidewalk or Sidewalk Ramp: This work will be measured by the actual number of square feet of completed and accepted concrete sidewalk or ramp.

2. Excavation: Excavation below the finished grade of the sidewalk or ramp, backfilling, and disposal of surplus material will not be measured for payment, but the cost shall be included in the price bid for the sidewalk or ramp. Excavation above the finished grade of the sidewalk or ramp will be measured and paid for in accordance with Section 2.02.

3. Gravel or Reclaimed Miscellaneous Aggregate Base: This work will not be measured for payment, but the cost shall be considered as included in the price bid for the sidewalk or ramp.

4. Detectable Warning Strip: For new construction (cast in place), the detectable warning strip will be measured for payment by the actual number of each ramp where a

detectable warning strip has been installed and accepted regardless of the number of tiles installed.

5. Retrofit Detectable Warning Strip: For retrofit construction (surface applied), the detectable warning strip will be measured for payment by the actual number of each ramp where a detectable warning strip has been installed and accepted regardless of the number of tiles installed.

6. Construction Staking: The establishment of control points and limits of grading will be measured in accordance with the item "Construction Staking."

9.21.05—Basis of Payment: Construction of a concrete sidewalk or ramp will be paid for at the Contract unit price per square foot for "Concrete Sidewalk," or "Concrete Sidewalk Ramp" complete in place, which price shall include all excavation as specified above, backfill, disposal of surplus material, curb removal and any monolithic or separately cast sidewalk curb when required for the sidewalk ramp as shown on the plans, gravel or reclaimed miscellaneous aggregate base, equipment, tools, materials and labor incidental thereto.

A new detectable warning strip will be paid for at the Contract unit price for each ramp where the detectable warning strip has been installed complete in place. This price shall include all tiles, materials, equipment, tools and labor incidental thereto.

Retrofitting the existing concrete sidewalk with a detectable warning strip will be paid for at the Contract unit price for each ramp where the retrofit detectable warning strip has been installed complete in place. This price will include all tiles, saw cutting concrete, adhesive, drilling holes for fasteners, materials, equipment, tools and labor incidental there to.

The establishment of control points and limits of grading will be paid for in accordance with the item "Construction Staking."

Pay Item	Pay Unit
Concrete Sidewalk	s.f.
Concrete Sidewalk Ramp	s.f.
Detectable Warning Strip	ea.
Retrofit Detectable Warning Strip	ea.

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 9.22
BITUMINOUS CONCRETE SIDEWALK
BITUMINOUS CONCRETE DRIVEWAY**

9.22.03 – Construction Methods:

Replace the first paragraph with the following:

“1. Excavation: Excavation, including saw cutting, removal of any existing sidewalk, or driveway, shall be made to the required depth below the finished grade, as shown on the plans or as directed by the Engineer. All soft and yielding material shall be removed and replaced with suitable material.”

9.22.05 – Basis of Payment:

Replace the only paragraph with the following:

“This work will be paid for at the contract unit price per square yard (square meter) for "Bituminous Concrete Sidewalk" or "Bituminous Concrete Driveway," as the case may be, complete in place, which price shall include all saw cutting, excavation as specified above, backfill, disposal of surplus material, gravel or reclaimed miscellaneous aggregate base, and all equipment, tools, labor and materials incidental thereto.”

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 9.44
TOPSOIL**

9.44.03—Construction Methods:

Add the following paragraph to the beginning of the article:

“The Contractor shall notify the Engineer of the location of the topsoil at least 15 calendar days prior to delivery. The topsoil and its source shall be inspected and approved by the Engineer before the material is delivered to the project. Any material delivered to the project, which does not meet specifications or which has become mixed with undue amounts of subsoil during any operation at the source or during placing and spreading, will be rejected and shall be replaced by the Contractor with acceptable material.”

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 9.49
FURNISHING, PLANTING and MULCHING
TREES, SHRUBS, VINES and GROUND COVER PLANTS**

9.49.03 – Construction Methods:

Replace subarticle “5. Pits” with the following:

“5. Pits: The pit diameters shall be twice the diameter of the root-spread or container diameters, and shall be 2- inches (50 millimeters) less than the height of the rootball measured from the bottom of the ball to the root collar. (i. e. A 12-inch (300 millimeters) measurement between the root collar and the bottom of the rootball will require a 10-inch (250 millimeters) deep pit). Any excavation in excess of that required shall be replaced with planting soil and compacted to the satisfaction of the Engineer.”

Add the following sentence to subsection “6. Obstructions Below Ground:”

“If removal of obstructions results in a deeper hole than needed for planting, backfill material shall be added and compacted to the satisfaction of the Engineer.”

Replace subarticle “7. Preparation of Backfill” with the following:

“7. Backfill: Backfill shall conform to M.13.01-1 Planting Soil.”

Replace subarticle “8. Setting Plants” with the following:

“8. Setting Plants: All plants shall be plumb and at a level that is 2-inches (50 millimeters) higher than the surrounding ground. Backfill material for all plants shall be thoroughly and properly settled by firming or tamping. Thorough watering shall accompany backfilling. Saucers capable of holding water shall be formed at individual plants (exclusive of plant beds) by placing ridges of planting soil around each, or as directed by the Engineer.

a. Balled and Burlapped plants: Plants shall be handled in such manner so that the soil will not be loosened from the roots inside of the ball. Carefully place the plant into the prepared pits and backfill with planting soil to one - half the depth of the pit, thoroughly tamp to the satisfaction of the Engineer around the ball. Fill the remaining area of the pit with water. Once water has completely drained, loosen the burlap and peel down the top one third. If wire baskets are used, cut and bend down the top third of the basket. Roots that have been wrapped around the ball within the burlap shall be straightened and the remainder of the pit filled with planting soil tamped to ensure that no air pockets remain.

b. Container Grown Plants: Carefully remove the plant from the container over the prepared pits. Gently loosen the soil and straighten all roots as naturally as possible. Place into the bottom of the pit. Backfill with planting soil to one - half the depth of the pit. Thoroughly tamp to the satisfaction of the Engineer. Fill remaining area of the pit with water. Once water has completely drained fill the remainder of the pit with planting soil tamped to ensure that no air pockets remain.

c. Bare-roots Plants: Carefully spread roots as naturally as possible and place into the bottom of the pit. All broken or frayed roots shall be cleanly cut off. Backfill with planting soil to one - half the depth of the pit. Thoroughly tamp to the satisfaction of the Engineer. Fill remaining area of the pit with water. Once water has completely drained fill the remainder of the pit with planting soil tamped to ensure that no air pockets remain.”

Replace subarticle “10. Watering” with the following:

“10. Watering: All plants shall be watered upon setting and as many times thereafter as conditions warrant.

The following is a guide for minimum requirements:

Trees:

2 ½” Caliper and less – Fifteen (15) gallons each.

3” to 5” Caliper – Twenty (20) gallon each.

5 ½” Caliper and above – Twenty-five (25) gallon each.

Shrubs:

24” and less – Six (6) gallon each.

More than 24”- Ten (10) gallon each.

Vines, Perennials, and Ornamental Grasses – Three (3) gallons each.

Groundcovers and Bulbs – Two (2) gallons per square foot.

Water shall be applied at a controlled rate and in such a manner to ensure that the water reaches the root zone (saucer) of the plant or plant bed and does not run off to adjacent areas. Watering shall be applied in a manner that does not dislodge plants, erode soil or mulch, or cause damage to saucer.

The Contractor may use slow-release, drip irrigation bags for watering in accordance with manufacturer’s instructions. The use of these portable/temporary irrigation bags will require the approval of the Engineer.

Overhead hydro-seeder spray nozzles shall not be used as watering devices.”

Replace subarticle “17. Establishment Period” with the following:

“17. One-Year Establishment Period: All plant material shall be subject to a One-Year Establishment Period. During this time, the Contractor shall use currently accepted horticultural practices to keep all plant material installed in a healthy, vigorous growing condition at the date of final acceptance. The date of final acceptance shall be one full

calendar year following the satisfactory completion of the planting activities as confirmed by the Engineer.

An inspection will be held one year from the date of installation with the Contractor, Engineer, and Landscape Designer to determine the acceptability of the plant establishment. An inventory of losses and rejected materials will be made and corrective and necessary clean up measures will be determined at the plant inspection."

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 9.75
MOBILIZATION**

Delete the entire section and replace with the following new section:

**SECTION 9.75
MOBILIZATION AND PROJECT CLOSEOUT**

9.75.01 – Description: This item consists of

1. all work necessary for moving Project personnel and equipment to the Project Site;
2. all work necessary for the establishment of the Contractors' field offices, buildings and other facilities necessary for Contract performance;
3. the preparation of work plans and other documents that must be submitted by the Contractor to the Department prior to the start of physical Project construction. These initial submittals are identified elsewhere in the Contract and may include Project schedules, Project management plans, staging and storage areas, safety plans, quality control plans, erosion and sedimentation control plans, and other documents addressing general Project sequencing or management;
4. demobilization of plant and equipment;
5. completion of all physical work, and
6. completion of administrative closeout items as required by the Contract.

The work entailed in this item shall not be subcontracted in whole or part.

9.75.04 – Method of Measurement: This work will be measured for payment in the manner described hereinafter; however, the total Contract amount earned will not include payments for mobilization that were earned during the period covered by the current monthly estimate, but will include those payments for mobilization that were previously earned and certified for payment.

1. When the first Project payment estimate is reviewed by the Engineer, twenty-five percent (25%) of the lump sum bid price for this item or two and a half percent (2.5%) of the total original Contract price, whichever is less, will be certified for payment as a part of that estimate.
2. When the Contractor's initial Project submittals are accepted by the Engineer, fifty percent (50%) of the lump sum bid price for this item or five percent (5%) of the total original Contract price, whichever is less, minus any previous Project payments made to the Contractor for this item, will be certified for payment.
3. When the Contractor's initial Project submittals are accepted by the Engineer, and fifteen percent (15%) of the total original Contract price has been earned by the Contractor, seventy percent (70%) of the lump sum price of this item or seven percent (7%) of the total original Contract price, whichever is less, minus any previous Project payments made to the Contractor for this item, will be certified for payment.
4. When thirty percent (30%) of the total original Contract price has been earned by the Contractor, eighty-five percent (85%) of the lump sum price of this item or eight and a half percent (8.5%) of the total original Contract price, whichever is less, minus any previous payments made to the Contractor for this item, will be certified for payment.

5. When the requirements of Article 1.08.13 have been satisfied by the Contractor, ninety-five percent (95%) of the lump sum price of this item, minus any previous payments made to the Contractor for this item, will be certified for payment.
6. When the requirements of Article 1.08.14 have been satisfied by the Contractor, one hundred percent (100%) of the lump sum price of this item, minus any previous payments made to the Contractor for this item, will be certified for payment. When this payment is made, the Contractor should have received full Contract payment for this item.

Nothing herein shall be construed to limit or preclude the Department from making partial payments to the Contractor that are provided for elsewhere in this Contract.

9.75.05 – Basis of Payment: The work under this item will be paid for at the Contract lump sum price for “Mobilization and Project Closeout,” which price shall include materials, equipment, tools, transportation, labor and all work incidental thereto.

Payment for this item shall be made only once; *i.e.*, for only one instance of mobilization as described in Article 9.75.01 above. If the Contractor mobilizes equipment or facilities more than one time during the course of the Project, due to reasons solely the responsibility of the Department, the additional work entailed therein will be paid for as Extra Work under Section 1.04.05 hereof.

Pay Item	Pay Unit
Mobilization and Project Closeout	I.s. (I.s.)

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 9.77
TRAFFIC CONE**

9.77.02—Materials:

Change the end of the last sentence as follows:

“ Traffic cones used at night shall be reflectorized by utilizing Type VI or Type IX Retroreflective Sheeting, in accordance with Article M.18.09.”

Add the following paragraph after the only paragraph:

“ Prior to using traffic cones on the project, the Contractor shall submit to the Engineer a copy of the manufacturer’s self-certification that the traffic cones comply with the requirements of the NCHRP Report 350 or the AASHTO MASH for Category 1 Devices.”

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 9.78
TRAFFIC DRUM**

9.78.02—Materials:

Delete the second and third paragraph and replace with the following:

“ Type IX Retroreflective Sheeting, in accordance with Article M.18.09, shall be used on traffic drums. Only one type sheeting shall be used on a drum and all drums furnished on a construction project shall be manufactured with the same type retroreflective sheeting.

Prior to using traffic drums on the project, the Contractor shall submit to the Engineer a copy of the manufacturer’s self-certification that the traffic drums comply with the requirements of the NCHRP Report 350 or the AASHTO MASH for Category 1 Devices.”

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 9.79
CONSTRUCTION BARRICADES**

9.79.01—Description:

Delete the entire article and replace with the following:

“9.79.01—Description: Under this item the Contractor shall furnish all construction barricades of the specified type required on the Project to comply with the requirements of NCHRP Report 350 (TL-3), or the AASHTO MASH, and the requirements stated in the item "Maintenance and Protection of Traffic," as shown on the plans and as directed by the Engineer.”

9.79.02—Materials:

Delete the last two paragraphs and replace with the following:

“ Alternate stripes of white and orange Type IV or Type IX retroreflective sheeting shall be applied to the horizontal members as shown on the plans. Only one type sheeting shall be used on a barricade and all barricades furnished on a construction project shall have the same type of retroreflective sheeting. Retroreflective sheeting shall conform to the requirements of Article M.18.09.

Construction barricades shall be designed and fabricated so as to prevent them from being blown over or displaced by the wind from passing vehicles. Construction barricades shall be approved by the Engineer before they are used.

Materials Certificates shall be required confirming compliance with the requirements set forth in the plans and specifications for these barricades.

Prior to using barricades on the Project, the Contractor shall submit to the Engineer a copy of the Letter of Acceptance issued by the FHWA to the manufacturer documenting that the barricades comply with the requirements of NCHRP Report 350 (TL-3) or the AASHTO MASH for Category 2 Devices.”

9.79.03—Construction Methods:

Delete the second paragraph in its entirety.

Delete the third and fourth paragraphs and replace with the following:

“ Ineffective barricades, as determined by the Engineer and in accordance with ATSSA guidelines contained in “Quality Standards for Work Zone Traffic Control Devices,” shall be replaced by the Contractor at no cost to the State.

Barricades that are no longer required shall be removed from the Project and shall remain the property of the Contractor.”

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 9.80
CONSTRUCTION STAKING**

Delete the entire Section and replace with the following:

**SECTION 9.80
CONSTRUCTION STAKING**

9.80.01—Description: The work under this item shall consist of construction layout and reference staking necessary for the proper control and satisfactory completion of work on the Project, however establishment of Property lines, highway lines, or non-access lines shall not be deemed work under this item.

This item shall also include all construction layout and reference staking required for identifying construction features within 25 ft (7.625 m) of regulated areas, and for the proper placement of all relocated underground and aerial utilities.

9.80.02—Materials: Stakes used for control staking shall be a minimum of 1 in x 1 in (25 mm x 25 mm) in width and a minimum of 18 in (0.5 m) in length. Stakes shall be legibly marked and shall be visible from the edge of the travelway, and shall be durable enough to last for the duration of the Contract. In areas where traditional staking cannot be established, other materials or methods may be used to mark critical locations, as approved or directed by the Engineer. For slope limits, pavement edges, gutter lines, etc., where so-called "green" or "working" stakes are commonly used, lesser quality stakes will be acceptable, provided that the stakes are suitable for the intended purpose

9.80.03—Construction Methods: The Department will furnish the Contractor such control points, bench marks, and other data as may be necessary for the construction staking and layout by qualified engineering or surveying personnel as noted elsewhere herein.

The Contractor shall be responsible for the placement and preservation of adequate ties to reference points necessary for the accurate re-establishment of base lines, center lines and at all critical locations, including all line-striping and grooving for line-striping, and grades as shown on the plans or directed by the Engineer.

Stakes, references, and batter boards required for construction operations, signing and traffic control shall be furnished, set and properly referenced by the Contractor. The Contractor shall be solely and completely responsible for the accuracy of the line and grade of all features of the work. The Contractor shall call to the Engineer's attention immediately any errors or apparent discrepancies found in previous surveys, plans, specifications or special provisions for correction or interpretation prior to proceeding with the affected work.

During roadway construction (or Site work), the Contractor shall provide and maintain for the appropriate periods, as determined by the Engineer, reference stakes at maximum 100-ft (30-m) intervals outside the slope limits. Further, the Contractor shall provide and maintain reference stakes at 50-ft (15-m) intervals immediately prior to and during the formation of subgrade and the construction of subsequent pavement layers.

These stakes shall be properly marked as to station and offset, and shall be referenced to the proposed grade.

Wetland Areas: When identified in the Contract, the Contractor shall provide additional reference stakes to assist the Engineer and regulatory personnel in the duties at regulated areas, including inland wetlands, tidal wetlands and watercourses. The Contractor shall place additional reference stakes to identify all slope limits, culvert ends, endwalls, riprap areas and other construction features within 25 ft (7.625 m) of regulated areas. For the placement of these additional stakes the regulated areas, approximate slope limits and other construction features are those shown on the environmental permit plates included in the Contract, or the latest revisions available. The Contractor shall provide stakes at a maximum spacing of 50 ft (15 m). Each stake shall be marked in a manner acceptable to the Engineer, to identify the baseline station and offset, and the feature it represents. The Contractor shall maintain or replace these stakes until the Engineer approves their removal.

Utility Relocations: The Contractor shall provide additional reference stakes to assist the Engineer and public utility personnel to accurately identify the proposed locations for utility facilities to be relocated. At least two weeks prior to the scheduled relocation of public utilities, the Contractor shall stake out the following features throughout the limits of utility relocations:

1. The proposed edge of road on the side adjacent to the proposed utility relocations.
2. Both edges of proposed sidewalks, where shown on the plans.

The Contractor shall provide stakes at a maximum spacing of 25 ft (7.625 m), unless directed otherwise by the Engineer.

The Contractor shall provide and maintain reference stakes at structures such as drainage structures, and shall include additional reference stakes for the determination of the structure alignments as may be needed for the proper construction of the drainage or other structure. The reference stakes shall be placed immediately prior to, and maintained during, the installation of the drainage structure. These stakes shall be properly marked as to station and offset, and shall be referenced to the proposed grade.

The Contractor shall furnish to the Engineer copies of any data used in setting and referencing stakes and other layout markings used by the Contractor after completion of each related operation, if requested to do so by the Engineer.

The Contractor shall provide safe facilities for convenient access by Department forces to all survey stakes, control points, batter boards, and references when requested to do so by the Engineer.

All staking shall be performed by qualified engineering or surveying personnel trained, experienced and skilled in construction layout and staking of the type required under the Contract. Prior to the start of related work, the Contractor shall submit to the Engineer for review and comment the qualifications of personnel responsible for construction staking on the Project. The submission shall include a description of the experience and training that the proposed personnel possesses and a list of State projects that the personnel have worked on previously. On all bridge projects, surveying shall be performed under the direct supervision of a Professional Surveyor licensed in the State of Connecticut. All field layout and staking required for the Project shall be performed under the direct supervision of a person, or persons, with engineering background, experienced in the direction of such work and acceptable to the Engineer. If the personnel responsible for construction staking should change during the course of the

Project, a revised submittal will be required prior to the Contractor's being allowed access to the Site.

The Department may check the control of the work, as established by the Contractor, at any time. The Contractor will be informed of the results of these checks, but the Department, by so doing, in no way relieves the Contractor of responsibility for the accuracy of the layout work. The Contractor shall correct or replace, at the Contractor's own expense, any deficient layout and construction work that may result from inaccuracies in the Contractor's staking operations from its failure to report such inaccuracies found in work done by the Department or by others. If, as a result of such inaccuracies, the Department is required to make further studies, redesign, or both, the Department will deduct all expenses incurred by the Department in doing so from any monies it owes to the Contractor.

The Contractor shall furnish all necessary personnel, surveying instruments, engineering equipment and supplies, materials, transportation, and work incidental to the accurate and satisfactory completion of work under this item.

For roadways where the existing pavement markings need to be reestablished or grooved markings are to be used: Prior to any resurfacing or obliteration of existing pavement markings, the Contractor and a representative of the Engineer must establish and document pavement marking control points from the existing markings. These control points shall be used to reestablish the positions of the lanes, the beginnings and endings of tapers, channelization lines for on- and off-ramps, lane-use arrows, stop bars, driveways, private drives, road entrances, and any lane transitions in the Project area, including all line striping grooving. The Contractor shall use these control points to provide appropriate premarking prior to the installation of final markings, including grooves.

The Contractor shall provide and maintain reference stakes or markings at 100-ft (30-m) intervals immediately off the edge of pavement, so that the Contractor will later be able to reestablish the existing pavement markings and necessary line stripe grooving limits. The Contractor shall also provide and maintain additional reference stakes and/or markings at any point where there is a change in pavement markings, so that the Contractor will later be able to reestablish the existing pavement markings and grooving limits.

For non-limited access roadways: On non-limited access roadways the Contractor may need to adjust the final locations of the pavement marking or grooving limits in light of a need to accommodate pedestrian and bicycle traffic. Prior to any resurfacing or obliteration of existing pavement markings, the Contractor, the Engineer, and a representative from the Division of Traffic Engineering must establish and document pavement marking control points from the existing marking and grooving limits as described above. The control points at that time may be adjusted to provide wider shoulders while maintaining through travel lane widths of no less than 11 ft (3.3 m). Suggested lane/shoulder widths for commonly encountered half sections are shown in the table below.

Centerline to curb or edge of road	Lane width	Shoulder width
12 to 16 ft (3.6 to 4.9 m)	11 ft (3.3 m)	Remaining Pavement
17 to 20 ft (5.2 to 6.1 m)	12 ft (3.6 m)	Remaining Pavement

9.80.04—Method of Measurement: Construction staking will be measured for payment as a Contract lump sum item.

9.80.05—Basis of Payment: Construction staking will be paid for at the Contract lump sum price for "Construction Staking," which price shall include all maintenance, materials, tools, equipment, labor and work incidental thereto, including removal of materials. The Contractor shall submit to the Department a schedule of payment values for review and comment prior to payment.

Pay Item	Pay Unit
Construction Staking	l.s. (l.s.)

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 9.81
42 INCH (1 METER) TRAFFIC CONE**

9.81.01—Description:

Delete the only sentence and replace with the following:

“ This item shall consist of furnishing 42-inch (1.07-meter) retroflective traffic cones required on the Project to meet the requirements of the traffic control plans, as stated in the item "Maintenance and Protection of Traffic," as shown on the plans or as directed by the Engineer.”

9.81.02—Materials:

Delete the last two paragraphs and replace with the following:

“ Retroflective stripes shall be fabricated from Type IX retroflective sheeting. All stripes shall be of one type of sheeting. Retroflective sheeting shall conform to Article M.18.09. Prior to using traffic cones on the Project, the Contractor shall submit to the Engineer a copy of the manufacturer’s self-certification that the traffic cones comply with the requirements of NCHRP Report 350 or the AASHTO MASH for Category 1 Devices.”

9.81.03-Construction Methods:

In the first sentence, change “manufacturers” to “manufacturer’s.”

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 10.00
GENERAL CLAUSES FOR HIGHWAY
ILLUMINATION AND TRAFFIC SIGNAL
PROJECTS**

Add the following new article after 10.00.13 Service Installations:

“ 10.00.14- Maintenance of Illumination During Construction: The Contractor shall organize the Project work so that any portion of roadway which has existing roadway illumination and is open for use remains lighted. The Contractor shall also provide illumination on all temporary crossovers, ramps and roadways that are constructed as part of staged construction and that are open for use. Highway illumination may consist of: existing lighting, new lighting, temporary lighting, or any combination thereof. It is the Contractor's responsibility to stage the installation or relocation of service cabinets, poles, lights, and circuitry so that all roadways of the kind described above remain lighted. If it is necessary to install temporary poles, lights, or circuitry to maintain the integrity of the highway illumination system, such work shall be submitted to the Engineer for approval prior to installation, and will be paid for at the Contract bid unit price for the relevant items. Temporary illumination work not specifically covered by the Contract specifications and pay items will be paid for as extra work at the discretion of the Engineer.

If the Contract includes temporary illumination plans, those plans shall serve as a framework for providing roadway illumination during construction. Temporary illumination plans may not represent the full extent of the temporary illumination work required, or the exact quantity of temporary lights required to maintain proper roadway illumination.

Prior to the start of any work that will interfere with the existing lighting system, the Contractor and ConnDOT District Electrical Maintenance personnel shall inspect the system for lighting outages, pole knockdowns, and circuit malfunctions. Deficiencies will be noted and repaired by Department forces prior to the start of work by the Contractor.

Once the Contractor's work interferes with or impacts the existing roadway lighting system, maintenance of that system within the Project limits becomes the Contractor's responsibility. The repair of lighting system malfunctions occurring outside of the project limits, caused by the Contractor's work, shall also be the Contractor's responsibility. District Construction personnel will note the start and end date of the Contractor's responsibility for maintenance of any existing lighting system.

The Contractor shall maintain the illumination throughout the duration of the Project, until the Project is accepted by the State. The Contractor shall supply to the Project Engineer and to the ConnDOT District Electrical Maintenance Supervisor, the names and phone numbers of a primary and back-up representative, to be contacted should a problem with the lighting system occur.

Whoever discovers a lighting outage or pole damage/knockdown within the Project limits shall immediately notify ConnDOT Highway Operations of same as follows:

1. For projects in Districts 1, 2, and 4, call (860) 594-3447.
2. For projects in District 3 and along the Interstate 95 corridor within District 2, call (203) 696-2690.

The following procedures will be followed for lighting outages:

- 1) Once notified of a lighting outage, ConnDOT Electrical Maintenance personnel will assess the situation, and in the case of a pole knockdown, may clear the pole from the roadway and make safe any exposed wires.
- 2) The Project Inspector and the Contractor's designated representative shall be notified after the lighting outage has been assessed by ConnDOT Electrical Maintenance, transferring responsibility for further repairs to the Contractor.
- 3) Upon notification, the Contractor shall be responsible to repair the lighting system before the normal nighttime turn-on of the lights. If this cannot be achieved, the Contractor shall make the lighting operational prior to the next normal nighttime turn-on of the lights, up to a maximum of 24 hours from the time the Contractor was notified of the problem. The Contractor shall contact the Project Inspector to discuss the situation, the steps to be taken to bring the lighting back on line, and the time frame for doing so.
- 4) For isolated individual luminaire outages (not a continuous circuit), the Contractor shall repair such luminaires within 48 hours from the time that the Contractor became aware of the outage.

The Contractor shall follow standard "lock-out," "tag-out," and "Call Before You Dig" procedures when working on the lighting circuit. Both the Contractor and ConnDOT Electrical Maintenance shall have mutual access to active lighting control cabinets.

The Contractor will be reimbursed for any costs associated with the maintenance of the existing lighting system that are beyond the Contractor's control. Reimbursements will be for damage caused by the general public and normal system age related component failures (such as lamp burn-out, ballast/starter failure or cable splice failure). However, the Contractor shall be responsible for repair of damage to the existing lighting system incurred as the result of their operations including damage caused by improper wiring methods. All repairs or replacements due to the Contractor's operations shall be made by the Contractor at their expense.

The Project Inspector will maintain a log book of any lighting repair work performed, which will include a description of the repairs, and the date the work was performed. The log book will be made accessible to ConnDOT Electrical Maintenance personnel.

Temporary illumination circuitry shall consist of pre-assembled aerial cable of the type and size as indicated in the Contract documents or as directed by the Engineer.

The Contractor shall notify the Engineer when aerial cable cannot be installed due to construction activities and shall suggest another method for installation of the cable.

Alternate options may include installing cable in duct underground, or installing surface-mounted cable in duct or PVC conduit with cable along the backside of a bridge parapet or temporary concrete barrier curbing. Temporary cable in duct/conduit or aerial cable lying directly on the ground will not be allowed. The option of surface-mounting duct or conduit to the backside of a parapet or barrier will be allowed only when construction activities make it necessary, and where the surface-mounted conduit will not expose workers to a high voltage hazard. The Contractor must obtain the Engineer's approval to do so prior to installing temporary circuitry not installed overhead, unless otherwise indicated on the plans.

When temporary circuitry is installed in trench, standard warning tape procedures shall be followed as set forth in Article 1.05.15. When temporary circuitry is surface mounted to the backside of a parapet or barrier wall, the Contractor shall install warning placards which read: "Live Electricity." Warning placards shall be installed at the beginning, end, and at intermittent points 100 feet (30 meters) apart along the exposed length of the duct/conduit. All temporary lighting circuits shall include a continuous No. 8 bare copper grounding conductor connected to all light standards and effectively grounded as per the NEC."

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 10.01
TRENCHING AND BACKFILLING**

10.01.01- Description:

In the only sentence of the first paragraph after "...satisfactory..." add the following: "clean-up and".

In the only sentence of the second paragraph after "...reconstruction of..." add the following: "bituminous, concrete and granite curbing,".

10.01.05- Basis of Payment:

In the only sentence of the second paragraph after "...mulching..." add the following: "clean-up and". After "...installing..." add the word "curbing,".

At the end of the third paragraph, add the following: "In the absence of a "Rock in Trench Excavation" item, the work will be compensated as extra work."

In the only sentence of the sixth paragraph, after "...unit price for 'Concrete Sidewalk'..." add the following: "or as extra work, if no unit price has been established."

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 10.10
CONCRETE HANDHOLE**

10.10.02 – Materials:

Replace “M.03.01” with “M.03” for both Class A and Class C Concrete.

10.10.05 – Basis of Payment

In the first sentence, remove the words “ground wire”.

At the end of the paragraph add the following sentence:

“The ground wire (bonding wire) is included in the Contract unit price under Section 10.08 – Electrical Conduit.”

Add the word “Cover” to the end of the pay item “Cast Iron Handhole”

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 11.13
CONTROL CABLE**

11.13.03 – Construction Methods:

In the 1st paragraph of subsection 2 replace “MIL” with “MILSPEC.”

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 12.07
SIGN FACE – EXTRUDED ALUMINUM**

Change the Section title from “Sign Face – Extruded Aluminum (Type III Reflective Sheeting)” to “Sign Face – Extruded Aluminum.”

12.07.01—Description:

In the first sentence, change “reflective” to “retroreflective.”

12.07.03—Construction Methods:

In the first sentence of the second paragraph, change “Reflective” to “Retroreflective.”

In the second sentence of the second paragraph, change “reflective” to “retroreflective.”

After the last paragraph, add the following:

“ All overhead sign foundations shall be field staked. The locations of the stakes shall be accepted by an Engineer from the Division of Traffic Engineering, a minimum of seven (7) days prior to installation.

For all side mounted signs, the edge of the sign closest to the roadway and the sign foundation shall be field staked and accepted by an Engineer from the Division of Traffic Engineering, a minimum of seven (7) days prior to installation.

For side-mounted signs, the offset to the near edge of the sign face shall exceed the maximum deflection of the guide rail, unless otherwise shown on the plans or directed by the Engineer.”

12.07.05—Basis of Payment:

In the Pay Item – Pay Unit table, delete “(Type IV Reflective Sheeting).”

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 12.08
SIGN FACE – SHEET ALUMINUM**

12.08.01—Description:

Delete the only paragraph and replace with the following:

“ This item shall consist of furnishing and installing sign face-sheet aluminum signs of the type specified, metal sign posts, span-mounted sign brackets and mast arm-mounted sign brackets at locations indicated on the plans or as ordered and complying with the requirements of the plans and these Specifications.”

12.08.02—Materials:

Delete the entire article and replace with the following:

“ Retroreflective sheeting shall meet the requirements of Article M.18.09, Type IV or IX. Sheet aluminum sign blanks shall meet the requirements of Article M.18.13. Silk screening of Type IV or IX retroreflective sheeting shall meet the requirements specified by the retroreflective sheeting manufacturer. Metal sign posts shall meet the requirements of Article M.18.14. Sign mounting bolts shall meet the requirements of Article M.18.15.”

12.08.03—Construction Methods:

In the first sentence of the first paragraph, change “... shall conform to ...” to “...shall be as shown in ...”

In the second, third and fourth sentences of the first paragraph, change “reflective” to “retroreflective.”

In the third and fourth sentences of the first paragraph, change “Type III reflective” to “Type IV or IX retroreflective.”

In the first sentence of the second paragraph, change “Reflective” to “Retroreflective.”

In the second sentence of the second paragraph, change “reflective” to “retroreflective.”

In the first sentence of the third paragraph, change “Type I, Type II or Type III reflective” to “Type IV or IX retroreflective.”

In the first and second sentences of the third paragraph, change “reflective” to “retroreflective.”

In the last sentence of the third paragraph, change “Type I or Type II reflective” to “Type IV or IX retroreflective.”

Delete the last sentence of the last paragraph.

12.08.05—Basis of Payment:

In the only paragraph, delete “... or parapet mounted sign support ...”

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 12.10
EPOXY RESIN PAVEMENT MARKINGS, SYMBOLS AND LEGENDS**

12.10.03—Construction Methods:

2. Procedures:

Insert the following after the sixth paragraph:

“The epoxy shall be uniformly applied to the surface to be marked to ensure a wet film thickness of the applied epoxy, without glass beads, of 20 mils +/- 1 mil (500 um +/- 25 um).”

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 12.20
CONSTRUCTION SIGNS—
TYPE III REFLECTIVE SHEETING**

Delete the entire Section, including “Type III Reflective Sheeting” in the title, and replace it with the following:

**SECTION 12.20
CONSTRUCTION SIGNS**

12.20.01—Description: Under this item the Contractor shall furnish, install and remove construction signs with retroreflective sheeting and their required portable supports or metal sign posts that comply with the requirements of NCHRP Report 350 (TL-3) or MASH for Category 2 Devices. The construction signs and their required portable supports or metal sign posts shall comply with the signing requirements stated in the item "Maintenance and Protection of Traffic," as shown on the plans and/or as directed by the Engineer. The Contractor shall furnish a sufficient number of signs to provide the signing patterns for all operations which are being undertaken concurrently.

12.20.02—Materials: Prior to using the construction signs and their portable supports, the Contractor shall submit to the Engineer a copy of the Letter of Acceptance issued by the FHWA to the manufacturer documenting that the devices (both sign and portable support tested together) comply with the requirements of NCHRP Report 350 (TL-3) or MASH for Category 2 Devices.

All sign faces shall be rigid and reflectorized and shall meet the requirements of Article M.18.09. If used as rigid substrate, sheet aluminum sign blanks shall comply with the requirements of Article M.18.13. Metal sign posts shall comply with the requirements of Article M.18.14. Application of retroreflective sheeting, legends, symbols, and borders shall comply with the requirements specified by the retroreflective sheeting manufacturer. Attachments shall be provided so that the signs can be firmly attached to the portable sign supports or metal posts without causing damage to the signs.

12.20.03—Construction Methods: The signs and their portable supports or metal posts shall comply with the requirements as shown on the plans and the latest edition of the "Manual on Uniformed Traffic Control Devices." Drawings of the signs, showing placement and dimensions of legend and border, are available for inspection at the Division of Traffic, Connecticut Department of Transportation.

Various types of portable sign supports may be used. These portable supports shall be fabricated in such a manner as to minimize the possibility of the signs being blown over or displaced by the wind from passing vehicles and are to be of a yielding type to withstand impact with minimal damage to the signs, supports, or vehicles. Portable sign supports shall be approved by the Engineer before they are utilized on the Project. Mounting height of signs on portable sign supports shall be a minimum of 1 ft (0.3 m)

and a maximum of 2 ft (0.6 m), measured from the pavement to the bottom of the sign.

Signs in other than good condition shall be replaced with acceptable signs as determined by the Engineer.

Suitable attachments shall be provided so that the signs can be firmly attached to the portable sign supports or metal posts without causing damage to the signs.

The following types of construction signs shall not be used: mesh, non-rigid, roll-up, corrugated or waffle board types substrates, foam core and composite aluminum sign substrates.

Field Performance: Retroreflective sheeting processed and applied to sign blank materials in accordance with the sheeting manufacturer's recommendations, shall perform effectively for a minimum of three (3) years. The retroreflective sheeting will be considered unsatisfactory if it has deteriorated due to natural causes to the extent that: (1) the sign is ineffective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions; or (2) the coefficient of retroreflection is less than 100 when measured at 0.2 degree observation angle and -4 degree entrance angle. All measurements shall be made after sign cleaning according to the sheeting manufacturer's recommendations.

Ineffective signs, as determined by the Engineer and in accordance with the ATSSA guidelines contained in "Quality Standards for Work Zone Traffic Control Devices," shall be replaced by the Contractor at no cost to the State.

Signs and their portable sign supports or metal posts that are no longer required shall be removed from the Project and shall remain the property of the Contractor.

12.20.04—Method of Measurement: The work to furnish, install and remove construction signs will be measured for payment by the number of square feet (square meters) of sign face delivered and used on the Project. Sign supports will not be measured for payment.

12.20.05—Basis of Payment: This item will be paid for at the Contract unit price per square foot (square meter) for "Construction Signs," delivered and used on the Project, which price shall include the signs, portable sign supports, metal sign posts and all hardware required to attach the sign to the support or posts. Each sign and support or posts furnished will be paid for once, regardless of the number of times used on the Project.

Pay Item
Construction Signs

Pay Unit
s.f. (s.m)

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 18.00
GENERAL CLAUSES -
IMPACT ATTENUATION SYSTEMS**

18.00.01—Description:

Change the end of the first sentence "... with the Specifications and in conformity with the Plans or as directed by the Engineer." to "... with the plans and Specifications or as directed by the Engineer."

18.00.02—Performance Criteria:

Delete the entire article and replace it with the following:

" These devices shall have approval in writing from FHWA documenting that they comply with the requirements of the NCHRP Report 350 or the AASHTO MASH for Category 3 Devices."

18.00.05—Delineation of Impact Attenuation Systems:

Delete the entire article and replace it with the following:

" All impact attenuation systems shall have an attenuator reflector attached to the front of the system, as shown on the plans."

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION 18.06
TYPE D PORTABLE IMPACT ATTENUATION SYSTEM**

18.06.02—Materials:

Delete the first two paragraphs and replace with the following:

“ Prior to using a new TMA, the Contractor shall submit to the Engineer a materials certificate in accordance with Article 1.06.07 for each system supplied and a copy of the FHWA Letter of Acceptance issued to the manufacturer documenting that the device complies with the requirements of the NCHRP Report 350 (TL-3) or the AASHTO MASH for Category 3 Devices.

If the system is not furnished new, the Contractor shall document and demonstrate to the Engineer's satisfaction that the system complies with the requirements of a new system, NCHRP Report 350 (TL-2), or the AASHTO MASH and may be used until the end of the attenuation device's useful service life.”

In the second sentence of the sixth paragraph, change “Type III retro-reflective” to “Type IV retroreflective.”

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION M.03
PORTLAND CEMENT CONCRETE**

Delete the entire Section and replace it with the following:

**SECTION M.03
PORTLAND CEMENT CONCRETE**

- M.03.01 - Component Materials**
- M.03.02 - Mix Design Requirements**
- M.03.03 - Producer Equipment and Production Requirements**
- M.03.04 - Curing Materials**
- M.03.05 - Non Shrink, Non Staining Grout**
- M.03.06 - Expansive Cement for Anchoring**
- M.03.07 - Chemical Anchors**
- M.03.08 - Joint Materials**
- M.03.09 - Protective Compound/Sealers**
- M.03.10 - Formwork**

M.03.01 – Component Materials

1. Coarse Aggregate: Coarse aggregate shall be broken stone, gravel, or reclaimed concrete aggregate defined as mortar-coated rock, consisting of clean durable fragments of uniform quality throughout. It shall be free from soft, disintegrated pieces, mud, dirt, organic or other injurious material and shall not contain more than 1 percent of dust by mass, as determined by AASHTO T-11. Coarse aggregate of a size retained on a 1-inch (25 mm) square opening sieve shall not contain more than 8% of flat or elongated pieces, whose longest dimension exceeds 5 times their maximum thickness. Heating or cooling of coarse aggregates may be required to meet concrete mix temperature requirements at time of placement.

- (a) Soundness:** When tested with magnesium sulfate solution for soundness, using AASHTO Method T 104, coarse aggregate shall not have a loss of more than 10% at the end of 5 cycles.
- (b) Loss on Abrasion:** When tested by means of the Los Angeles Machine, using AASHTO Method T 96, coarse aggregate shall not have a loss of more than 40%.
- (c) Gradation:** Grading and stone sizes of the coarse aggregate shall conform to Article M.01.01 as determined by AASHTO T-27. All coarse aggregate proportions shall be approved in advance by the Transportation Division Chief (TDC) as part of the Mix Design requirements.
- (d) Storage:** Aggregate stockpiles shall be located on smooth, hard, sloped/well-drained areas. Each source and gradation shall have an individual stockpile or bin. Aggregates shall be handled from stockpiles or other sources to the batching plant in such manner as to minimize segregation of the material. Aggregates that have become segregated, or mixed with earth or foreign material, shall not be used.

- (e) **Reclaimed Concrete Aggregate:** In addition to the above requirements (a-d), when reclaimed concrete aggregate is proposed, it shall be tested for chloride in AASHTO T-260 "Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials." Aggregate shall not be used if the chloride content as determined from this test exceeds 0.5 pound/cubic yard (297 g/cubic meter). Regardless of chloride content, reclaimed concrete aggregate shall not be used in concrete mixes used for pre-stressed concrete construction.

2. Fine Aggregate: Fine aggregate shall be natural or manufactured sand consisting of clean, hard, durable, uncoated particles of quartz or other rock, free from lumps of clay, soft or flaky material, mica, loam, organic or other injurious material. In no case shall fine aggregate containing lumps of frozen material be used. Heating or cooling of fine aggregates may be required to meet concrete mix temperature requirements at time of placement.

For continued shipments of fine aggregate from a given source, the fineness modulus of any sample shall not vary more than 0.20 from the base fineness modulus. The base fineness modulus for a source shall be established by the Engineer and may be revised based on current testing results.

- (a) **Fine Material:** Fine aggregate shall contain not more than 3% of material finer than a #200 sieve (75µm), as determined by AASHTO T 11.
- (b) **Organic Impurities:** Fine aggregate subjected to the colorimetric test shall not produce a color darker than Gardner Color Standard No. 11, using AASHTO T 21. If the fine aggregate fails to meet this requirement, the provisions of AASHTO M 6, Section 7.2.3, may apply.
- (c) **Gradation:** Fine aggregate gradation shall be within the ranges listed in Table M.03.01-1 for any source. All fine aggregate proportions shall be approved in advance by the TDC as part of the Mix Design requirements.
- (d) **Soundness:** When tested with magnesium sulfate solution for soundness, using AASHTO T 104, fine aggregate shall not have a loss of more than 10% at the end of 5 cycles. Fine aggregate that fails to meet this requirement, but meets all other requirements, may be allowed for use on a restricted basis with the approval of the Engineer on a case-by-case basis. Typically concrete forming any surface subject to polishing or erosion from running water will not be allowed to contain such material.
- (e) **Storage:** Aggregate stockpiles shall be located on smooth, hard, sloped/well-drained areas. Each source and gradation shall have an individual stockpile or bin. Aggregates shall be handled from stockpiles or other sources to the batching plant in such manner as to minimize segregation of the material. Aggregates that have become segregated, or mixed with earth or foreign material, shall not be used.

Table M.03.01-1 TOTAL % PASSING BY WEIGHT

Sieve Size	3/8" (9.5mm)	No. 4 (4.75mm)	No. 8 (2.36mm)	No. 16 (1.18mm)	No. 30 (600µm)	No. 50 (300µm)	No. 100 (150µm)
Percent Passing	100	95-100	80-100	50-85	25-60	10-30	2-10

3. Cement:

- (a) **Portland:** Types I, II, and III Portland cement shall conform to the requirements of AASHTO M 85. Type I and Type III Portland cement shall be used only when required or expressly permitted by the Project specification or the Engineer. The use of Type I or III will require that these mixtures be submitted as Non-standard Mix Designs. All cement shall be provided by a mill participating in the Departments' Cement Certification program. The requirements of the Certification Program are detailed in the Department's Quality Assurance Program for Materials.
- (b) **Pre-Blended Cements:** Binary or Ternary cements consisting of Portland Cement and supplemental cementitious materials may be used provided that all the requirements of Subarticles M.03.01- 3(a) and -3(c) are met.

- (c) Replacement Materials:** Unless already approved as a Standard Mix Design, any Contractor proposed Mix Designs with partial replacement of Portland Cement (PC) with fly ash or ground granulated blast furnace slag (GGBFS), shall be submitted in writing to the Engineer for approval prior to the start of work, on a project-by-project basis. The type of material, source, and the percentage of the PC replaced shall be clearly indicated. Upon request, a Certified Test Report for the cement replacement material shall be provided to the Engineer for use during the Mix Design review.
1. Fly Ash: Fly ash to be used as a partial replacement for Portland cement shall meet the requirements of AASHTO M 295, either Class C or Class F, including the uniformity requirements of Table 2A. Loss on Ignition for either class of fly ash shall not exceed 4.0%. Fly ash may be used to replace up to a maximum of 20% of the required Portland cement. The fly ash shall be substituted on a weight (mass) basis, with a minimum of 1 pound (45 kg) of fly ash for 1 pound (45 kg) of Portland cement. Different classes of fly ash or the same class from different sources shall not be permitted on any single project without the written approval of the Engineer.
 2. Ground Granulated Blast Furnace Slag (GGBFS): GGBFS used as a partial replacement for Portland cement shall conform to the requirements of AASHTO M 302/ASTM C989, Grade 100 or 120. As determined by the Engineer, GGBFS may be used to replace a maximum of 30% of the required Portland cement. The Engineer may restrict or prohibit the use of GGBFS if ambient temperatures anticipated during the placement and initial curing of the concrete are low. The GGBFS shall be substituted on a weight (mass) basis, with a minimum of 1 pound (45 kg) of slag for 1 pound (45 kg) of Portland cement. Different sources of GGBFS shall not be permitted on any single project without the written approval of the Engineer.
- 4. Water:** All water used in the mixing of concrete shall be clear in appearance and free from oil, salt, acids, alkalis, sugar, and organic matter. Surface water may be used if not taken from shallow or muddy sources; classified as Class C or Class D on the Department of Energy and Environmental Protection (DEEP) Water Quality Classification mapping; and accommodations have been made to prevent contaminants from entering the supply to the satisfaction of the Engineer. The Engineer may request that water from any surface or ground source be tested in accordance with AASHTO T26 and AASHTO D512 if the appearance or scent of the water is suspect. To be acceptable, the pH of the water must not be less than 6.0 or greater than 8.0 and Chloride Ion Concentration of the water must not exceed 250ppm (250 mg/L). Potable water taken directly from a municipal or regional water supply may be used for mixing concrete without testing. Heating or cooling of water may be required to meet mix temperature requirements at time of placement.
- 5. Admixtures:** All admixtures shall perform their function without injurious effects upon the concrete. If requested by the TDC, the Contractor shall present a certified statement from a recognized laboratory attesting to this requirement. A "recognized" laboratory is any cement and concrete laboratory approved and inspected regularly by the Cement and Concrete Reference Laboratory (CCRL). The statement shall contain results of compression tests of cylinder specimens made with concrete utilizing the admixture(s) in proportions equal to those proposed by the Contractor. The results of at least 5 standard 6-inch x 12-inch (150 mm x 300 mm) cylinders of each mix design shall be listed with the results of at least 5 like-sized cylinders not utilizing the admixture(s). Specimens must be made and cured in the laboratory in accordance with AASHTO T 126 and will be tested in accordance with AASHTO T 22.
- (a) Air-Entraining Admixtures:** In the event that air entrained concrete is required, an admixture conforming to the requirements of AASHTO M 154 may be used. Tests for 7 and 28-day compressive and flexural strengths and resistance to freezing and thawing are required, but tests for bleeding, bond strength and volume change will not be required.

- (b) Other Chemical Admixtures:** In the event that concrete properties are specified that require the use of additional admixtures, or the Contractor proposes the use of additional admixtures to facilitate placement, the admixtures shall conform to the requirements of AASHTO M194M/M, including the 1 year performance data.

M.03.02 – Mix Design Requirements

1. Standard ConnDOT Mix Designs: Standard Mix Designs shall be designed in accordance with applicable sections of ACI 211 and ACI 318. The mixtures shall consist of Portland cement, fine aggregate, coarse aggregate, admixtures¹, and water proportioned in accordance with Table M.03.02-1. The mixtures shall also be designed to obtain the physical properties of plastic concrete as specified in Article 6.01.03.

Table M.03.02-1

TYPE	28-day Minimum Compressive Strength psi (megapascals)	Water / Cement; or Water / Cement plus other approved Cementitious Material, by weight (mass), Maximum	Minimum Cement ² Required lbs/cy (kg/cm)	Maximum Aggregate Size Required Section M.01.01
Class "A"	3300 (23)	0.53	615 (365)	No. 4
Class "C"	3300 (23)	0.53	658 (390)	No. 6
Class "F"	4400 (30)	0.44	658 (390)	No. 6
Pavement	3500 (24)	0.49	615 (365)	No. 4
Slope Paving	2200 (15)	0.69	455 (270)	No. 3
¹ Approved admixtures may be used in proportions recommended by the manufacturer.				
² Portland Cement may be partially replaced within a Standard Mix Design by other approved cementitious material meeting the requirements of Article M.03.01-3(b) if permitted by the Engineer.				

Mix designs shall indicate the dosage of admixtures anticipated to provide plastic properties required in the Project specification. Properties of standard classes of concrete in the plastic state are listed in Article 6.01.03

Standard Mix Designs are required to be designed and submitted by the concrete producers, and are approved by the Department on a standing basis. Submittal or re-approval of these Standard Mix Designs on an annual basis is not required. Previously approved producer-designed Standard Mixes that have a record of satisfactory performance may be utilized on Department projects unless there is a change in the gravimetric properties or the sources of any materials. Revisions to the Standard Mix Designs, which include changes in component sources, can be submitted at any time to the TDC, but must be approved prior to use on Department projects.

2. Non-Standard ConnDOT Mix Designs: Any proposed Mix Designs that do not comply with Table M.03.02-1 are required to be submitted 15 days prior to use on a project-by-project basis and be approved by the TDC prior to use. The use of an approved admixture with an otherwise approved Standard Mix Design is not considered non-standard.

All Non-standard Mix Designs used for load-bearing structures shall contain a minimum of 658 lbs/cubic yard (390 kg/cubic meter) of cementitious materials.

Concrete used in applications such as flowable fill or controlled low-strength material may be designed with less than 658 lbs/cubic yard (390 kg/cubic meter) of cementitious materials.

M.03.03 - Producer Equipment and Production Requirements

1. General Requirements: The source of the concrete must be approved by the Engineer prior to use on Department projects. Specifically the location and capacity of the central mix or dry batch plant, and complement of truck mixers/haulers, shall be adequate for continuous placement of concrete on a typical Department project. Approval may be revoked at any time in accordance with Section 1.06.01.

- (a) Inspection:** The production facility supplying hydraulic cement concrete shall have a current Certification of Ready Mixed Concrete Production Facilities from the National Ready Mixed Concrete Association (NRMCA), or equivalent certification approved by the Engineer.
 - (b)** In addition to the requirements of approved third party certification, the facility shall produce batch tickets that conform to Subarticle 6.01.03-3(a).
 - (c) Quality Control:** The Contractor is responsible for all aspects of Quality Control (QC). As determined by the Engineer, should material delivered to a project not meet specification, the Contractor may be required to submit to the Engineer a corrective procedure for approval within 3 calendar days. The procedure shall address any minor adjustments or corrections made to the equipment or procedures at the facility.
 - (d) Suspension:** As determined by the Engineer, repeated or frequent delivery of deficient material to a Department project may be grounds for suspension of that source of material. A detailed QC plan that describes all QC policies and procedures for that facility may be required to formally address quality issues. This plan must be approved by the Engineer and fully implemented, prior to reinstatement of that facility.
- 2. Hand Mixed Concrete:** Hand mixing shall be permitted only with the permission of the Engineer. Hand mixed batches shall not exceed 1/2 cubic yard (0.5 cubic meter) in volume. Hand mixing will not be permitted for concrete to be placed under water.

M.03.04 - Curing Materials

1. Water: Any water source deemed acceptable by the Engineer for mixing concrete may be used to provide water for curing purposes. Surface water may be used if classified as Class C or Class D on the Department of Energy and Environmental Protection (DEEP) Water Quality Classification mapping and accommodations have been made to prevent contaminants from entering the supply to the satisfaction of the Engineer.

In general, water shall not be taken from shallow or muddy sources. In cases where sources of supply are relatively shallow, the intake pipe shall be enclosed to exclude silt, mud, grass, etc.; and the water in the enclosure shall be maintained at a depth of not less than 2 feet (610 mm) under the intake pipe.

2. Mats: Mats for curing concrete shall be capable of maintaining moisture uniformly on the surface of the concrete. The mats shall not contain any materials such as dyes, sugar, etc., that may be injurious to the concrete.

The length or width of the mats shall be sufficient to cover all concrete surfaces being cured. Should more than one mat be required, sufficient overlap shall be provided by the Contractor as determined by the Engineer.

3. Liquid Membrane-Forming Compound: Liquid membrane-forming compound shall conform to the requirements of AASHTO M 148 Type 2, Class B, or shall be a water-soluble linseed oil-based compound conforming to the requirements of AASHTO M 148, Type 2.

4. White Polyethylene Sheeting (Film): White polyethylene sheeting (film) shall conform to the requirements of AASHTO M 171.

M.03.05 - Non Shrink, Non Staining Grout

1. Bagged (pre-mixed): Bagged (pre-mixed) formulations of non-shrink grout shall meet the requirements of ASTM C 1107. The grout shall be mixed with potable water for use. The grout shall be mixed to a flowable consistency as determined by ASTM C 230. All bagged material shall be clearly marked with the manufacturer's name, date of production, batch number, and written instructions for proper mixing, placement and curing of the product.

2. Bulk: The Contractor may formulate and design a grout mix for use on the Project in lieu of using a pre-bagged product. The Contractor shall obtain prior written approval of the Engineer for any such proposed Mix Design. Any such Mix Design shall include the proportions of hydraulic cement, potable water, fine aggregates, expansive agent, and any other necessary additive or admixture. This material shall meet all of the same chemical and physical requirements as shall the pre-bagged grout, in accordance with ASTM C 1107.

M.03.06 – Expansive Cement for Anchoring

The premixed anchoring cement shall be non-metallic, concrete gray in color and prepackaged. The mix shall consist of hydraulic cement, fine aggregate, expansive admixtures and water conforming to the following requirements:

1. The anchoring cement shall have a minimum 24 hour compressive strength of 2,600 psi (18 megapascals) when tested in accordance with ASTM C 109.
2. The water content of the anchoring cement shall be as recommended by the manufacturer. Water shall conform to the requirements of Subarticle M.03.01-4.

The Contractor shall provide a Certified Test Report and Materials Certificate for the premixed anchoring cement in conformance with Article 1.06.07. The Contractor shall also provide, when requested by the Engineer, samples of the premixed anchoring cement for testing and approval.

M.03.07 – Chemical Anchors

Chemical anchor material must be listed on the Departments' Qualified Products List and approved by the Engineer for the specified use.

The chemical anchor material shall be epoxy or polyester polymer resin. It shall not contain any metals or other products that promote corrosion of steel. The Contractor shall supply the Engineer with a Certified Test Report and Materials Certificate for the chemical anchor material in conformance with Article 1.06.07. When requested by the Engineer, the Contractor shall also provide samples of the chemical anchor material.

M.03.08 – Joint Materials

1. **Transverse Joints for Concrete Pavement:** Transverse joints shall consist of corrosion resistant load transfer devices, poured joint seal and in addition, in the case of expansion joints, expansion joint filler all conforming to the following requirements:
 - (a) The corrosion resistant load transfer device shall be coated steel or sleeved steel or be made of corrosion resistant material. The dimensions of any devices used shall be as shown on the plans, exclusive of any coating or sleeving. Core material of coated or sleeved metallic devices shall be steel meeting the requirements of AASHTO M 255M/M 255 Grade 520, or steel having equal or better properties and approved by the Engineer. Nonmetallic devices shall meet the various strength requirements applicable to metallic devices as well as all other requirements stated herein.
 - (b) All coated load transfer devices shall conform to the requirements of AASHTO M 254. Uncoated or sleeved load transfer devices shall meet the applicable physical requirements of AASHTO M 254. The use of field applied bond breakers will not be permitted.

- (c) The basis of acceptance for corrosion resistant load transfer devices shall be the submission by the Contractor of a minimum of 2 samples accompanied by Certified Test Reports conforming to the requirements of Article 1.06.07 demonstrating that the load transfer device conforms to the requirements of AASHTO M 254 for the type of device supplied. The Engineer reserves the right to reject any load transfer device which he deems unsatisfactory for use.
2. **Joint Filler for Concrete Curbing:** Expansion joint filler shall be either preformed expansion joint filler or wood joint filler as indicated on the plans and shall conform to the following requirements:
- (a) Preformed expansion joint filler shall be the bituminous cellular type and shall conform to the requirements of AASHTO M 213.
 - (b) Boards for wood joint filler shall have 2 planed sides and shall be redwood, cypress or white pine. Redwood and cypress boards shall be of sound heartwood. White pine boards shall be of sound sapwood. Occasional small, sound knots and medium surface checks will be permitted provided the board is free of any defects that will impair its usefulness for the purpose intended. The joint filler may be composed of more than one length of board in the length of the joint, but no board of a length less than 6 feet (1.9 meters) shall be used; and the separate boards shall be held securely to form a straight joint. Boards composed of pieces that are jointed and glued shall be considered as one board.
 - (c) Dimensions shall be as specified or shown on the plans; and tolerances of plus 1/16-inch (1.6 millimeters) thickness, plus 1/8-inch (3.2 millimeters) depth and plus 1/4-inch (6.4 millimeters) length will be permitted.
 - (d) All wood joint filler boards shall be given a preservative treatment by brushing with creosote oil conforming to AASHTO M 133. After treatment, the boards shall be stacked in piles, each layer separated from the next by spacers at least 1/4 inch (6.4 millimeters) thick; and the boards shall not be used until 24 hours after treatment. Prior to concreting, all exposed surfaces of the wood filler shall be given a light brush coating of form oil.
 - (e) Testing of board expansion joint filler shall be in accordance with pertinent sections of AASHTO T 42.
3. **Longitudinal Joint Devices:** The metal used in the fabrication of longitudinal joint devices shall conform to ASTM requirements for each type of metal used. The dimensions shall be as shown on the plans.
4. **Expansion Joint Fillers for Bridges and Bridge Bearings:**
- (a) Preformed expansion joint filler for bridges shall conform to the requirements of AASHTO M 153, Type I or Type II.
 - (b) Pre-molded expansion joint filler for bridge bearings shall conform to the requirements of AASHTO M 33.
5. **Joint Sealants:**
- (a) **Joint Sealer for Pavement:** The joint sealer for pavement shall be a rubber compound of the hot-poured type and shall conform to the requirements of AASHTO M 324 Type II unless otherwise noted on the plans or in the special provisions.
 - (b) **Joint Sealer for Structures:** Structure joint sealers shall be one of the following type sealants:
 - 1. Where "Joint Seal" is specified on the plans, it shall conform to the Federal Specifications SS-S-200-E (Self-leveling type), TT-S-0227E (COM-NBS) Type II-Class A (Non-sag type), or 1 component polyurethane-base elastomeric sealants conforming to FS TT-S-00230C Type II-Class A or an approved equal.

A Certified Test Report will be required in accordance with Article 1.06.07, certifying the conformance of the sealant to the requirements set forth in the Federal Specification. Should the consignee noted on a Certified Test Report be other than the Prime Contractor, a Materials Certificate shall be required to identify the shipment.

2. Where "Silicone Joint Sealant" is specified on the plans, it shall be one of the following or an approved equal:
 - Sealant, manufactured by the Dow Corning Corporation, Midland, Michigan Dow Corning 888 Silicone Joint Sealant or
 - Dow Corning 888-SL Self-Leveling Silicone Joint 48686-0994
6. **Closed Cell Elastomer:** The closed cell elastomer shall conform to the requirements of ASTM D1056, Grade RE-41 B2. The elastomer shall have a pressure-sensitive adhesive backing on one side.

The Contractor shall deliver the closed cell elastomer to the job site a minimum of 30 days prior to installation. Prior to the delivery of the closed cell elastomer, the Contractor shall notify the Engineer of the date of shipment and the expected date of delivery. Upon delivery of the closed cell elastomer to the job site, the Contractor shall immediately notify the Engineer.

Each separate length, roll or container shall be clearly tagged or marked with the manufacturer's name, trademark and lot number. A lot is defined as that amount of closed cell elastomer manufactured at one time from one batch of elastomer. A batch is defined as that amount of elastomer prepared and compounded at one time. The Contractor shall furnish a Certified Test Report in accordance with Article 1.06.07, confirming the conformance of the closed cell elastomer to the requirements set forth in these specifications. Should the co-signee noted on a Certified Test Report be other than the Prime Contractor, a Materials Certificate shall be required to identify shipment.

The Contractor shall furnish a 1 foot (305 millimeter) length of closed cell elastomer in each lot for purposes of inspection and testing by the Engineer. The Engineer will cut a 1 foot (305 millimeter) sample from each lot and inspect the sample for conformance to size, and perform physical tests on the sample as deemed necessary.

The Engineer shall reject any lot or portion of a lot that does not conform to the requirements stated herein. A rejected lot or portion of a lot may be resubmitted provided the Contractor has removed or corrected, in a manner acceptable to the Engineer, all non-conforming material.

M.03.09 – Protective Compound/Sealers

The brand and type of material must be listed on the Department's Qualified Products List and approved by the Engineer for the specified use.

M.03.10 – Formwork

1. **Stay-in-place Forms:** Material for stay-in-place metal forms shall be made of zinc-coated (galvanized) steel sheet conforming to ASTM Specification A653 (Structural Steel (SS) Grade 33 through 80). The minimum thickness shall be 20 gage (810 micrometers). Coating weight shall conform to ASTM A924, Class G235, and shall otherwise meet all requirements relevant to steel stay-in-place metal forms and the placing of concrete as specified herein and as noted in the Contract documents.

Form supports shall either be fabricated and conform to the same material requirements as the forms, or be fabricated from structural steel conforming to the requirements of ASTM A36 and shall be hot-dip galvanized in accordance with ASTM A123.

Lightweight filler material for forms shall be as recommended by the form manufacturer.
2. **Temporary Forms and Falsework:** Forms and Falsework shall be of wood, steel or other material approved by the Engineer. This approval does not relieve the Contractor from employing adequately sized materials of sufficient rigidity to prevent objectionable distortion of the formed concrete surfaces caused by pressure of the plastic concrete and other loads incidental to the construction operations.

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION M.06
METALS**

M.06.01 – Reinforcing Steel:

1. Bar Reinforcement:

Delete the third paragraph and replace it with:

“Epoxy coated bar reinforcement shall conform to the requirements of ASTM A 615/A 615M, Grade 60 (420) and shall be epoxy coated to the requirements of ASTM A 775/A 775M. All field repairs of the epoxy coating shall conform to the requirements of ASTM D 3963/D 3963M.”

M.06.02—Structural Steel and Other Structural Materials:

Delete the entire article and replace it with the following:

"M.06.02—Structural Steel: The materials for this work shall conform to the following requirements:

1. Structural Steel:

Structural steel for bridges shall conform to the designation shown on the plans. Unless otherwise indicated in the plans or specifications, structural steel for non-bridge related members or components shall conform to ASTM A709/A709M, Grade 36 (250).

All surfaces of steel plates and shapes used in the fabrication of bridge girders shall be blast cleaned and visually inspected by the Contractor prior to any fabrication or preparation for fabrication. Blast cleaning shall conform to the requirements of SSPC-SP-6-Commercial Blast.

All steel plates and shapes used in the fabrication of bridge girders shall be substantially free from pitting and gouges, regardless of the cause. Substantially free is defined as:

- The measured surface area of all pits and gouges regardless of depth represent less than 1% of the surface area of the plate or shape.
- No pit or gouge greater than 1/32 (0.08mm) inch deep.
- No pit or gouge closer than six inches (15.25 cm) from another.

Any repair of plates or shapes will be performed in accordance with ASTM A6/A 6M.

2. Anchor Bolts:

Unless otherwise designated on the plans, anchor bolts, including suitable nuts and washers, shall conform to the following requirements:

Anchor bolt assemblies shall conform to the requirements of ASTM F1554, Grade 36 (250). All components of the bolt assembly shall be galvanized in conformance with ASTM A 153/A 153M.

Certified Test Reports and Material Samples: The Contractor shall submit notarized copies of Certified Test Reports in conformance with Article 1.06.07. Prior to incorporation into the work, the Contractor shall submit samples of the anchor bolt assemblies to the Engineer for testing in accordance with the latest edition of the "Schedule of Minimum Requirements for Acceptance Testing". One sample shall be submitted for each diameter, material designation, grade or coating of anchor bolt assembly.

3. High Strength Bolts: High strength bolts, including suitable nuts and hardened washers, shall conform to the following requirements:

- a) High strength bolts shall conform to ASTM A325 or ASTM A490 as shown on the plans. High-strength bolts used with coated steel shall be mechanically galvanized, unless otherwise specified. High-strength bolts used with uncoated weathering grades of steel shall be Type 3.

Nuts for ASTM A325 bolts shall conform to ASTM A563, grades DH, DH3, C, C3 and D. Where galvanized high-strength bolts are used, the nuts shall be galvanized, heat treated grade DH or DH3. Where Type 3 high-strength bolts are used, the nuts shall be grade C3 or DH3.

Nuts for ASTM A490 bolts shall conform to the requirements of ASTM A563, grades DH and DH3. Where Type 3 high-strength bolts are used, the nuts shall be grade DH3.

All galvanized nuts shall be lubricated with a lubricant containing a visible dye of any color that contrasts with the color of the galvanizing. Black bolts must be oily to the touch when delivered and installed.

Circular flat and square or rectangular beveled, hardened steel washers shall conform to ASTM F436. Unless otherwise specified, galvanized washers shall be furnished when galvanized high-strength bolts are specified, and washers with atmospheric corrosion resistance and weathering characteristics shall be furnished when Type 3 high-strength bolts are specified.

Compressible-washer-type direct tension indicator washers, used in conjunction with high strength bolts, shall conform to ASTM F959. Where galvanized high-strength bolts are used, the washers shall be galvanized in accordance with ASTM B695, Class 50. Where Type 3 high-strength bolts are used, the washers shall be galvanized in accordance with ASTM B695, Class 50 and coated with epoxy.

- b) Identifying Marks:** ASTM A325 for bolts and the specifications referenced therein for nuts require that bolts and nuts manufactured to the specification be identified by specific markings on the top of the bolt head and on one face of the nut. Head markings must identify the grade by the symbol "A325", the manufacturer and the type, if Type 2 or 3. Nut markings must identify the grade, the manufacturer and if Type 3, the type. Markings on direct tension indicators must identify the manufacturer and Type "325". Other washer markings must identify the manufacturer and if Type 3, the type.

ASTM A490 for bolts and the specifications reference therein for nuts require that bolts and nuts manufactured to the specifications be identified by specific markings on the top of the bolt head and on one face of the nut. Head markings must identify the grade by the symbol "A490", the manufacturer and the type, if Type 2 or 3. Nut markings must identify the grade, the manufacturer and if Type 3, the type. Markings on direct tension indicators must identify the manufacturer and Type "490". Other washer markings must identify the manufacturer and if Type 3, the type.

- c) Dimensions:** Bolt and nuts dimensions shall conform to the requirements for Heavy Hexagon Structural Bolts and for Heavy Semi-Finished Hexagon Nuts given in ANSI Standard B18.2.1 and B18.2.2, respectively.
- d) Galvanized Bolts:** Galvanized bolts shall conform to ASTM A325, Type 1. The bolts shall be hot-dip galvanized in accordance with ASTM A153, Class C or mechanically galvanized in accordance with ASTM B695, Class 50. Bolts, nuts, and washers of any assembly shall be galvanized by the same process. The nuts shall be overtapped to the minimum amount required for the fastener assembly, and shall be lubricated with a lubricant containing a visible dye so a visual check can be made for the lubricant at the time of field installation. Galvanized bolts shall be tension tested after galvanizing. ASTM A 490 bolts shall not be galvanized.
- e) Test Requirements:** The maximum hardness of A325 bolts 1" or less in diameter shall be 33 HRC.

Plain, ungalvanized nuts shall have a minimum hardness of 89 HRB.

Proof load tests, in accordance with the requirements of ASTM F606 Method 1, shall be required for the bolts. Wedge tests of full-size bolts are required in accordance with Section 8.3 of ASTM A325. Galvanized bolts shall be wedge tested after galvanizing. Proof load tests of ASTM A563 are required for nuts. Proof load tests for nuts used with galvanized bolts shall be performed after galvanizing, overtapping and lubricating.

Rotational-capacity tests are required and shall be performed on all plain or galvanized (after galvanizing) bolt, nut and washer assemblies by the manufacturer or distributor prior to shipping and by the Contractor at the job site.

The thickness of galvanizing on bolts, nuts and washers shall be measured. On bolts, it shall be measured on the wrench flats or on top of the bolt head, and on nuts it shall be measured on the wrench flats.

f) Certified Test Reports and Materials Certificates: The Contractor shall submit notarized copies of Certified Test Reports and Materials Certificates in conformance with Article 1.06.07 for fastener assemblies. In addition the Certified Test Reports and Materials Certificates shall include the following:

- a. Mill test reports shall indicate the place where the material was melted and manufactured.
- b. Test reports for proof load tests, wedge tests, and rotational-capacity tests shall indicate where the tests were performed, date of tests, location of where the components were manufactured and lot numbers.
- c. The test report for galvanized components shall indicate the thickness of the galvanizing.

g) Material Samples: Prior to incorporation into the work, the Contractor shall submit samples of the bolt assemblies to the Engineer for testing in accordance with the latest edition of the "Schedule of Minimum Requirements for Acceptance Testing". Samples shall be submitted for each diameter, length, material designation, grade, coating and manufacturer of bolt assembly.

4. Welded Stud Shear Connectors:

a) Materials: Stud shear connectors shall conform to the requirements of ASTM A 108, cold-drawn bar, Grades 1015, 1018 or 1020, either semi- or fully-killed. If flux-retaining caps are used, the steel for the caps shall be of a low carbon grade suitable for welding and shall comply with ASTM A 109.

Stud shear connectors shall be of a design suitable for electrically end-welding to steel with automatically timed stud welding equipment. The studs shall be of the sizes and dimensions noted on the plans. Flux for welding shall be furnished with each stud, either attached to the end of the stud or combined with the arc shield for automatic application in the welding operation. Each stud shall be furnished with a disposable ferrule of sufficient strength to remain intact during the welding operation and not crumble or break; it shall not be detrimental to the weld or create excessive slag.

Tensile properties, as determined by tests of bar stock after drawing or of finished studs, shall conform to the following requirements in which the yield strength is as determined by the 0.2% offset method:

Tensile strength (min.)	60,000 psi (415 megapascals)
Yield strength (min.)	50,000 psi (345 megapascals)
Elongation (min.)	20% in 2 inches (50 millimeters)
Reduction of area (min.)	50%

- b) Test Methods:** Tensile properties shall be determined in accordance with the applicable sections of ASTM A 370. Tensile tests of finished studs shall be made on studs welded to test plates using a test fixture similar to that shown in Figure 7.2 of the current AASHTO/AWS D1.5 – Bridge Welding Code. If fracture occurs outside of the middle half of the gage length, the test shall be repeated.
- c) Finish:** Finished studs shall be of uniform quality and condition, free from injurious laps, fins, seams, cracks, twists, bends or other injurious defects. Finish shall be as produced by cold-drawing, cold-rolling or machining.
- d) Certified Test Reports and Materials Certificates:** The Contractor shall submit a certified copy of the in-plant quality control test report in conformance with Article 1.06.07. The Contractor shall submit a Materials Certificate in conformance with Article 1.06.07 for the welded studs.
- e) Sample Materials for Testing:** Prior to incorporation into the work, the Contractor shall submit samples of the stud shear connectors to the Engineer for testing in accordance with the latest edition of the "Schedule of Minimum Requirements for Acceptance Testing". One sample shall be submitted for each diameter and length of welded stud."

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION M.08
DRAINAGE**

Delete the entire Section and replace with the following:

**SECTION M.08
DRAINAGE**

M.08.01 – Pipe

General

Iron/Steel

1. Cast Iron Pipe
2. Coated Corrugated Metal Pipe and Coated Corrugated Metal Pipe Elbows
3. Perforated or Plain Coated Metal Pipe for Underdrains or Outlets
4. Coated Corrugated Metal Pipe Arches
5. Corrugated Structural Plates and Bolts
6. Metal Culvert Ends

Concrete

7. Reinforced Concrete Pipe
8. Reinforced Concrete Elliptical Pipe
9. Perforated Reinforced Concrete Pipe for Underdrains and Outlets
10. Slotted Drain Pipe
11. Reinforced Concrete Culvert Ends

Aluminum

12. Corrugated Aluminum Pipe
13. Corrugated Aluminum Pipe for Underdrains and Outlets
14. Corrugated Aluminum Pipe Arches

Sealers/Gaskets

15. Cold-Applied Bituminous Sealer
16. Preformed Plastic Gaskets
17. Flexible, Watertight, Rubber-Type Gaskets

Plastic

18. Corrugated Polyethylene Pipe
19. Geotextiles
20. Polyvinyl Chloride Plastic Pipe
21. Polyvinyl Chloride Gravity Pipe

M.08.02 – Catch Basins, Manholes, and Drop Inlets

M.08.03 – Aggregates

1. Bedding Material
2. Aggregates for Underdrains

M.08.01 – Pipe

General

The Contractor shall submit manufacturer's material certifications for all metal and plastic pipes other than PVC, metal pipe-arches, metal fittings and metal coupling bands in accordance with Article 1.06.07.

IRON/STEEL

1. Cast Iron Pipe: This material shall conform to the requirements of AASHTO M 64 for Extra-Heavy Cast Iron Culvert Pipe.

2. Coated Corrugated Metal Pipe and Coated Corrugated Metal Pipe Elbows:
This material shall conform to the following:

Pipe fabricated from zinc-coated steel sheet and aluminum-coated (Type 2) steel sheet must conform to AASHTO M 36, Type 1 or IR.

Pipe fabricated from metallic-coated and polymer-precoated steel sheet must conform to AASHTO M 245, Type 1.

Unless otherwise indicated on the plans, the corrugation size and sheet thickness shall conform to the following:

Nominal Inside Diameter (inches)	Corrugations	Minimum Specified Sheet Thickness (inches)	
6	1 1/2" X 1/4"	.052	
8, 10	1 1/2" X 1/4"	.064	
12, 15, 18 & 21	2 2/3" X 1/2"	.064	
24, 30 , 36	2 2/3" X 1/2"	.079	
42, 48	2 2/3" X 1/2"	.109	
54, 60	3" X 1" or 5" X 1"	.064	
66, 72	3" X 1" or 5" X 1"	.079	
78, 84, 90, & 96	3" X 1" or 5" X 1"	.109	
		Steel	Aluminum
18, 24, 30	Helical Rib 3/4" X 3/4" X 7 1/2"	.064	.060
36	Helical Rib 3/4" X 3/4" X 7 1/2"	.064	.075
42, 48 & 54	Helical Rib 3/4" X 3/4" X 7 1/2"	.079	.105
60, 66, 72, 78, 84	Helical Rib 3/4" X 3/4" X 7 1/2"	.109	.135

Aluminum pipe sheet thickness may be .004 inch less than specified above for 1 1/2-inch x 1/4-inch, 2 2/3-inch x 1/2-inch and 3-inch x 1-inch or 5-inch x 1-inch corrugations. Helical Rib shall be as specified above.

Zinc coated steel pipe, fittings, and coupling bands shall be coated with bituminous material as specified in AASHTO M 190 Type C. Pipe, fittings and coupling bands

fabricated from aluminum coated steel sheet (Type 2) does not require coating of bituminous material or paved invert.

Metallic-coated and polymer-precoated steel pipe, fittings, and coupling bands shall be coated as specified in AASHTO M 246, Type B. The thicker polymeric coating shall be on the inside of the pipe.

Only one type of coating will be allowed for any continuously connected run of pipe.

If elongation of the pipe is required, it shall be done by the manufacturer.

3. Perforated or Plain Coated Metal Pipe for Underdrains or Outlets: This material shall conform to the requirements of AASHTO M 36, Type III or AASHTO M 245, Type III.

(a) Perforations: The minimum diameter of perforations after asphalt coating shall be 1/4 inch.

(b) Coating: All requirements of M.08.01-2 shall apply except that the minimum thickness of the bituminous coating on zinc coated steel pipe, fittings, and coupling bands pipe shall be 0.03 inches instead of 0.05 inches.

4. Coated Corrugated Metal Pipe-Arches: This material shall conform to the requirements of AASHTO M 36, Type II, Type IIR or AASHTO M 245, Type II. All coating requirements of M.08.01-1 shall apply.

Unless otherwise indicated on the plans, the corrugation size and sheet thickness shall conform to the following:

Pipe-Arch Equivalent Diameter (Inches)	Corrugations	Minimum Sheet Thickness (Inches)
15, 18, 21	2 2/3" X 1/2"	.064
24, 30	2 2/3" X 1/2"	.079
36, 42, 48	2 2/3" X 1/2"	.109
54, 60	2 2/3" X 1/2"	.138
60, 66, 72	3" X 1" or 5" X 1"	.079
78, 84, 90, 96	3" X 1" or 5" X 1"	.109
18, 21, 24	Helical Rib 3/4" X 3/4" X 7 1/2"	.064
30, 36	Helical Rib 3/4" X 3/4" X 7 1/2"	.079
42, 48, 54, 60	Helical Rib 3/4" X 3/4" X 7 1/2"	.109

5. Corrugated Structural Plates and Bolts: These plates and bolts are for use in the construction of metal pipe of the large diameter and for metal plate arches or pipe arches to be assembled in the field, and they shall conform to the requirements of AASHTO M 167 for corrugated metal pipe.

The dimensions of plates and details of fabrication shall conform to the requirements of the manufacturer. Where the plans call for a heavier gage for the bottom of the pipe than for the remainder of the pipe circumference, the lower fourth of the circumference shall be the minimum width of the heavier gage material.

The coating shall conform to the requirements of AASHTO M 243.

6. Metal Culvert End: The materials used in this work shall meet the pertinent requirements of Subarticles M.08.01-2 and M.08.01-4.

Bolts and fittings shall conform to the requirements of ASTM A 307 and shall be galvanized to conform to the requirements of ASTM A 153.

The units shall be coated as specified in Subarticles M.08.01-2, M.08.01-4 or M.08.01-5.

Fabrication: These units shall be formed from a rectangular sheet of metal by cutting and bending to form the desired shape. Two or more sheets may be fastened together by riveting or bolting so as to form a rectangular sheet of the required width. Skirt extensions and a top plate, as needed to complete the unit, shall be separately formed. Skirt extensions shall be riveted or bolted to the skirt.

All edges, which will be exposed above the surface of the ground, shall be reinforced before forming the unit by either of the following means:

- (1) The edge shall be bent to form a semicircular roll with an exterior diameter of 1 inch, as shown in the detail drawing on the plans.
- (2) A split tube of 1 inch outside diameter and not lighter than 14 gage, shall be slipped over a row of rivets spaced not more than 6 inches apart, as shown in the detail drawing on the plans.

One corrugation, matching the corrugations of the pipe or pipe-arch to which the unit is to be attached, shall be formed in the unit to insure secure and accurate alignment.

Attachment: The unit may be shop-riveted to a length of the appropriate pipe or pipe-arch, or may be field attached to the pipe or pipe arch by either of the other attachment systems shown on the plans, or by other means acceptable to the Engineer. If the unit is shop-riveted to a length of pipe or pipe-arch, this length shall be sufficient to permit proper use of standard coupling bands.

CONCRETE

7. Reinforced Concrete Pipe: Unless otherwise specified, this material shall conform to the requirements of AASHTO M 170, Class IV, as supplemented and modified by the following:

- (a) **Reinforcement:** In circular pipe, only circular reinforcement will be allowed.
- (b) **Laps and Welds:** The reinforcement shall be lapped not less than 2 inches and welded with an electric welding machine.
- (c) **Quality Assurance Testing:** Circular and elliptical reinforced concrete pipe shall be tested by the three-edge bearing method prescribed in AASHTO T 280, except as follows:
- 1) Modified or special design pipe shall be tested to the 0.01-inch load and the ultimate load requirements as per AASHTO M 170 and M 207.
 - 2) At the discretion of the Engineer, pipe of standard design, as specified in AASHTO M 170 and M 207, may be tested to the 0.01-inch requirement plus 10% additional load in lieu of ultimate load testing. Test pipe attaining a 0.01-inch crack will not be acceptable for use on Department projects.
 - 3) Cores for absorption and determination of steel reinforcement shall be taken on a random basis as determined by the Engineer. The cores shall be at least 6 inches in diameter.
- (d) **Inspection:** The pipe plant, materials, processes of manufacture and the finished pipe shall be subject to inspection and approval by the Department. The pipe manufacturer's records related to component materials, production and shipment of pipe for Department use shall be made available to the Department on request. The equipment and labor necessary for inspection, sampling and testing as required by the Department shall be furnished by the pipe manufacturer. Test equipment shall be calibrated at least once each 12 months, or as directed by the Engineer. The plant cement and aggregate scales shall be inspected and sealed by the approved agency at least once every twelve months.
- (e) **Preliminary Tests and Tests for Extended Deliveries:** As directed by the Engineer, the Department shall select for test from the stock of any manufacturer proposing to supply pipe to the Department, 2 of each size pipe up through 30-inch diameter and 1 of each size greater than 30-inch diameter. These sample pipes shall be tested under Department supervision by the three-edge bearing method. For pipe that fails, it shall be necessary for the manufacturer to either physically isolate the rejected pipe at his plant or to provide some means to clearly indicate the unacceptability of the pipe. Either method shall be performed to the satisfaction of the Engineer. When production is resumed on any size, wall thickness or class previously rejected, preliminary tests shall be required. If 95% of all pipe tested at a particular plant from the first of the calendar year to September 30 meet specifications, including both preliminary and extended tests, it will not be necessary to perform the Fall three-edge bearing tests at this plant.

Use of compression tests on representative cylinders or cores to determine the compressive strength of the concrete incorporated into the pipe products will be at the discretion of the Engineer.

(f) **Shipping:** Pipe shall not be shipped until it is at least 7 days old unless earlier shipment is authorized by the Engineer on the basis of tests.

(g) **Certification:** Pipe will be accepted by the Department on the basis of manufacturer's certification. The manufacturer shall certify each shipment of pipe on Department Form MAT-073(PC-1), "Certification of Precast Concrete Products." Two (2) copies of this certification shall be furnished with the shipment to the Engineer at the project site.

8. Reinforced Concrete Elliptical Pipe: This material shall conform to the requirements of AASHTO M 207, Class HE IV and supplemented as follows:

(a) Manufacturing and testing shall conform to Subarticle M.08.01-7.

9. Perforated Reinforced Concrete Pipe for Underdrains and Outlets: This material shall conform to the requirements of Subarticle M.08.01-7 and shall be slotted in accordance with AASHTO M 175, Type 2, or as shown on the plans. Pipe for outlets shall not be perforated.

10. Slotted Drain Pipe: The pipe shall be asphalt coated and conform to Subarticle M.08.01-2. Concrete shall conform to Article M.03.01, Class "A" or pavement type. Concrete shall be cured in conformance with M.03. The inlet aperture shall be longitudinal on top of the pipe and may be continuous or intermittent. The opening in the pipe wall may be fabricated in the form of continuous bar risers and spacers or of intermittent cut-out segments with structural members supporting a continuous grating as indicated in the plans. End caps shall be as provided by the manufacturer.

Elastomeric polymer sealer shall meet the physical requirements of ASTM D 3406 and be accepted on manufacturer's certification.

The pipe shall be helically corrugated with a continuous welded or lock seam. Pipe ends shall have 2 rolled annular corrugations on each end for jointing.

Bar Riser and Spacer Type: Riser assemblies shall be fabricated from structural steel, in accordance with the dimensions on the plans. The riser assemblies shall be hot dipped galvanized according to ASTM A123. The assemblies shall be welded to the corrugated pipe on each side of the riser at the location of the solid web spacers. The riser shall terminate 1 inch from the ends of each pipe length to allow clearance for single bolt coupling bands. The ends of the riser shall be closed with a suitable welded plate where solid web spacers do not come to the ends of the riser.

The maximum deviation from straight in both the vertical and horizontal plane of the riser assembly shall not exceed 3/4 inch in a 20-foot length.

Continuous Grating Type: The cut-out pipe segments shall provide a 2-inch wide slot of maximum length between the lock seams. The slot shall be left intact 1 inch on each side of the lock seam and this material shall be utilized to fasten the reinforcing bar in place.

A bent epoxy coated reinforcing bar shall cross the slotted opening on 6-inch centers.

The reinforcing bar shall be an ASTM A 615, No. 13, deformed bar epoxy coated with 7 mils of fusion bonded epoxy powder conforming to AASHTO M 284.

Grating shall be furnished unless noted in the contract documents. Grating and all bearing bars, cross bars, and bent connecting bars shall be welding quality, mild carbon steel conforming to ASTM A 569 and to the dimensions shown on the plans.

Tie down bolts shall be J-Type bolts, plated, ASTM A 307 steel supplied with self-locking nuts.

Concrete forms shall be of cellular foam plastic base, fabricated as an integral part of the pipe and reinforcing bar assembly. The form shall be capped with a thick wood or plastic cap resting on top of the foam plastic and reinforcing bar.

The maximum deviation from straight in both the vertical and horizontal plane of the completed assembly shall not exceed 3/4 inch in a 20-foot length. All grating and hardware shall be galvanized in conformance with Article M.06.03. Expansion joint filler shall conform to M.03.

11. Reinforced Concrete Culvert End: The barrel shall conform to the requirements of AASHTO M 170, Class II, except that the three-edge bearing tests will not be required. The flare shall be of the same thickness and materials as the barrel and shall have steel reinforcement equaling or exceeding the amount shown on the table for the pertinent size.

Tongues and grooves shall be compatible with tongues and grooves of pipe meeting AASHTO M 170, Class IV.

Air entrainment shall be added to these units so as to maintain 5 to 8% entrained air.

ALUMINUM

12. Corrugated Aluminum Pipe: This material shall conform to the requirements of AASHTO M 196 Type I or Type IR. Sheet thickness shall conform to the requirements of M.08.01-2.

13. Corrugated Aluminum Pipe for Underdrains and Outlets: This material shall conform to the requirements of AASHTO M 196, Type III or Type IIIR. Sheet thickness shall conform to the requirements of M.08.01-2. Pipe for outlets shall not be perforated.

14. Corrugated Aluminum Pipe Arches: These pipe arches shall conform to the requirements of AASHTO M 196, Type II or Type IIR. Sheet thickness shall conform to the requirements of M.08.01-4.

SEALERS/GASKETS

15. Cold-Applied Bituminous Sealer: This material, for use in sealing of joints in concrete pipes, shall be free of asbestos and shall meet the following requirements:

It shall be of such consistency that it may be spread on the joints with a trowel when

the temperature of the air is between -20° F and 100° F. The bituminous material shall adhere to the concrete pipe so as to make a watertight seal and shall not flow, crack or become brittle when exposed to the atmosphere.

Unless otherwise specified, sampling shall be done in accordance with AASHTO T 40.

The bituminous sealer shall be delivered to the project in suitable containers for handling and shall be sealed or otherwise protected from contamination. The container shall show the brand name, net mass or volume, and the requirements for application.

16. Preformed Plastic Gaskets: This material for use in sealing of joints in concrete pipe shall conform to the requirements of ASTM C 1478.

17. Flexible, Watertight, Rubber-Type Gaskets: This material for use in sealing concrete pipe joints shall conform to the requirements of ASTM C 443.

PLASTIC

18. Corrugated Polyethylene Pipe: Corrugated Polyethylene Pipe, either corrugated interior surface (Type C) or smooth interior surface (Type S) without perforations or with perforations (Type CP or SP), shall conform to AASHTO M 252 or M 294. Type D pipe shall have a smooth interior surface braced circumferentially or spirally with projections or ribs joined to a smooth outer wall. Both surfaces shall be fused to, or be continuous with, the internal supports. Type D shall conform to AASHTO M 294.

19. Geotextiles: The geotextile shall be non-rotting, acid and alkali resistant, and have sufficient strength and permeability for the purpose intended including handling and backfilling operations. Fibers shall be low water absorbent. The fiber network must be dimensionally stable and resistant to delamination. The geotextile shall be free of any chemical treatment or coating that will reduce its permeability. The geotextile shall also be free of any flaws or defects which will alter its physical properties. Torn or punctured geotextiles shall not be used. For each specific use, only geotextiles that are already on the Connecticut Department of Transportation's Qualified Products List for the geotextile type will be used. The Engineer reserves the right to reject any geotextile he deems unsatisfactory for a specific use. The brand name shall be labeled on the geotextile or the geotextile container. Geotextiles that are susceptible to damage from sunlight or heat shall be so identified by suitable warning information on the packaging material.

Geotextiles susceptible to sunlight damage shall not be used in any installations where exposure to light will exceed 30 days, unless specifically authorized in writing by the Engineer.

20. Polyvinyl Chloride Plastic Pipe: The pipe shall conform to the requirements of ASTM D 1785. Couplings and elbows shall conform to the requirements of ASTM D 2466 or D 2467.

21. Polyvinyl Chloride Gravity Pipe: This pipe shall conform to one of the following specifications: ASTM F 789, ASTM F 679, or ASTM F 794.

M.08.02—Catch Basins, Manholes, and Drop Inlets: The materials to be used in the construction shall conform to the following:

1. Brick for Catch Basins, Manholes or Drop Inlets: Brick for catch basins, manholes or drop inlets shall conform to the requirements of ASTM C 32, except that the depth shall be 2 1/4 inches, the width 3 5/8 inches, and the length 8 inches, and except that the maximum water-absorption by 5-hour boiling shall not exceed the following limits:

Average of 5 bricks	15%
Individual brick	18%

2. Concrete Building Brick for Catch Basins, Manholes, or Drop Inlets: Concrete building brick for catch basins, manholes, or drop inlets shall conform to the requirements of ASTM C 55, Grade S II.

3. Masonry Concrete Units for Catch Basins, Manholes, or Drop Inlets: Masonry concrete units for catch basins, manholes, or drop inlets shall conform to the requirements of ASTM C 139.

4. Precast Units for Drainage Structures: Precast units for drainage structures may be used except where particular conditions require building or casting structures in place.

Fabrication plants shall have a quality control plan approved by the Division Chief of Materials Testing that is demonstrated to the satisfaction of the Engineer. The facility, the quality of materials, the process of fabrication, and the finished precast units shall be subject to inspection by the Engineer.

Precast manholes shall conform to the requirements of AASHTO M 199 (ASTM C 478).

Circular precast catch basins and drop inlets shall conform to AASHTO M 199 (ASTM C 478) as supplemented below. Rectangular precast catch basins and drop inlets shall conform to ASTM C 913 as supplemented below:

All materials used for concrete shall conform to the requirements of Section M.03.

The pertinent provisions of Article 6.01.03 shall apply except that the concrete shall contain 5.0%-8.0% entrained air. Water-absorption of individual cores taken from precast units shall be not more than 7%.

Reinforcement shall conform to the requirements of Article M.06.01.

Suitable provision shall be made in casting the units for convenient handling of the completed casting, and additional reinforcement steel shall be provided to allow for such handling in the casting yard and during transportation and placement. Each completed unit shall be identified with the name of manufacturer and date of the concrete pour from which it was cast, either by casting this information into an exposed face of the unit or by suitable stencil. For each day's production of precast units, the

fabricator shall mold, cure, and test standard cylinders, or cylinders compacted in a similar manner to the parent precast units, for the purpose of determining the compressive strength of the concrete incorporated into the precast units. Concrete used in molding the cylinders shall be representative of the concrete incorporated into the precast units during the production period. Cylinders shall be molded in accordance with AASHTO T 23, cured by the same method as the units they represent, and tested as prescribed in AASHTO T 22.

The fabricator shall determine the air content of the concrete used in the day's production of precast units by performing tests as prescribed in AASHTO T 152.

The equipment and personnel necessary to perform the required testing shall be furnished by the fabricator and approved by the Engineer. All testing equipment shall be calibrated at least once each 12 months or as directed by the Engineer. The fabricator shall maintain records relative to the production, testing, and shipment of precast units supplied to the Department. Said records shall be available to a representative of the Department upon his request.

The Department may accept precast concrete units on the basis of fabricator's certification. The fabricator shall certify each shipment of precast concrete units on Department Form MAT 314 (PC-1), "Certification of Precast Concrete Products." Two (2) copies of this certification shall be furnished with the shipment to the Engineer at the Project site.

Precast units that are cracked, show evidence of honeycomb, or have over 10% of their surface area patched may be subject to rejection, even though meeting other requirements.

5. Metal for Drainage Structures: Metal for catch basins, drop inlet and manhole frames, extensions, covers, and gratings shall be cast iron, cast steel, structural steel or malleable iron conforming to the requirements of the plans. Covers and gratings shall bear uniformly on their supports.

Extensions shall be designed so that the existing manhole cover or catch basin grate, when set in place, will have substantially the same bearing, fit, and load carrying capacity as in the existing frame. The extension shall be designed to fit into the original frame, resting specifically on the flange and rim area. The extension shall accept the existing cover or grate so that the cover or grate is seated firmly without movement.

Ladder rungs for manholes shall conform to AASHTO M 199 (ASTM C 478).

Cast iron shall conform to the requirements of AASHTO M 105, Class 25 for the frames and Class 30 for gratings.

Cast steel shall conform to the requirements of ASTM A 27, Grade optional, and shall be thoroughly annealed.

Structural Steel shall conform to the requirements of ASTM A 36, or A 283, Grade B or better, as to quality and details of fabrication, except that in the chemical composition of the steel, the 2/10 of 1% of copper may be omitted.

Malleable iron shall conform to the requirements of ASTM A 47, Grade 22010.

The materials and method of manufacture for drop inlets shall conform to the requirements as stated on the plans or as ordered.

M.08.03—Aggregates

1. Bedding Material: Material for pipe bedding shall be sand or sandy soil, all of which passes a 3/8-inch sieve and not more than 10% passes a No. 200 sieve.

When ground water is encountered, the Engineer may allow No. 6 stone conforming to Article M.01.01 to be used instead of sand or sandy soil.

2. Aggregates for Underdrains: Materials for filling the trench shall consist of well-graded, clean, non-plastic sands or well-graded, clean, durable broken stone or screened gravel. Unless otherwise noted, the type of material to be used shall be sand.

Sand: This material shall meet the requirements of Subarticle M.03.01-2

Broken Stone or Screened Gravel: This material shall conform to the gradation requirements for Size No. 8 under Article M.01.01.

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION M.11
MASONRY FACING
CEMENT AND DRY RUBBLE MASONRY
BRICK
MORTAR**

M.11.01 – Masonry Facing:

1. Masonry Facing Stone:

Delete the third sentence:

“Preferably, the stone shall be from a quarry the product of which is known to be of satisfactory quality.”

Delete “2. : Vacant:”

M.11.04—Mortar:

Delete the entire article and replace it with the following:

M.11.04—Mortar: Mortar shall be either Pre-blended or Pre-packaged material conforming to:

ASTM C1714 - Standard Specification for Pre-blended Dry Mortar Mix for Unit Masonry;

ASTM C387 - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar;

or be composed of one part Portland cement and two parts, by volume, of surface dry fine aggregate blended on site.

Hydrated lime, in an amount not to exceed 4 pounds (1.8 kilograms) of lime to each bag of cement, may be added when the material is blended on site at the option of the Engineer. Cement and hydrated lime shall conform to the following requirements:

(a) Portland cement, Types I, II or IS, and water shall conform to the requirements of Article M.03.

(b) Hydrated lime shall conform to the requirements of ASTM C 6.

When mortar is mixed on the project site, **fine aggregate** shall conform to Grading A or B as indicated in the table below, and to the requirements of Section M.03. For laying stone, precast units, or for shotcrete, fine aggregate shall conform to Grading A. For pointing stone or the precast units and for laying brick or sealing pipe joints, the fine aggregate shall conform to Grading B.

Table of Gradation, Fine Aggregate for Mortar

<u>Square Mesh Sieves</u>	<u>Grading</u>	
	A	B
	Percentage Passing by weight (mass)	
Pass 3/8 inch (9.5 millimeters)	100	
Pass #4 (4.75 millimeters)	95-100	
Pass #8 (2.36 millimeters)	80-100	100
Pass #16 (1.18 millimeters)	50-85	
Pass #30 (600 microns)	25-60	
Pass #50 (300 microns)	10-30	10-40
Pass #100 (150 microns)	2-10	0-10

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION M.13
ROADSIDE DEVELOPMENT**

M.13.01—Topsoil:

Delete the entire article and replace it with the following:

“ M.13.01 – Topsoil: The term topsoil used herein shall mean a soil meeting the soil textural classes established by the USDA Classification System based upon the proportion of sand, silt, and clay size particles after passing a No. 10 (2 millimeter) sieve and subjected to a particle size analysis. The topsoil shall contain 5% to 20% organic matter as determined by loss on ignition of oven-dried samples dried at 221° F (105° C). The pH range of the topsoil shall be 5.5 to 7.0.

The following textural classes shall be acceptable:

Loamy sand, including coarse, loamy fine, and loamy very fine sand, with not more than 80% sand

Sandy loam, including coarse, fine and very fine sandy loam

Loam

Clay loam, with not more than 30% clay

Silt loam, with not more than 60% silt

Sandy clay loam, with not more than 30% clay

All textural classes of topsoil with greater than 80% sand content will be rejected.

The topsoil furnished by the Contractor shall be a natural, workable soil that is screened and free of subsoil, refuse, stumps, roots, brush, weeds, rocks and stones over 1 1/4 inches (30 millimeters) in diameter, and any other foreign matter that would be detrimental to the proper development of plant growth.

The Contractor shall notify the Engineer of the location of the topsoil at least 15 calendar days prior to delivery. The topsoil and its source shall be inspected and approved by the Engineer before the material is delivered to the project. Any material delivered to the project, which does not meet specifications or which has become mixed with undue amounts of subsoil during any operation at the source or during placing and spreading, will be rejected and shall be replaced by the Contractor with acceptable material.

When topsoil is not furnished by the Contractor, it shall be material that is stripped in accordance with Section 2.02 or is furnished by the State, and will be tested as determined by the Engineer.

1. Planting Soil: Soil Material to be used for plant backfill shall be one of the following textural classes:

Loamy sand, with not more than 80% sand
Sandy loam
Loam
Clay loam, with not more than 30% clay
Silt loam, with not more than 60% silt
Sandy clay loam, with not more than 30% clay

Planting soil shall be premixed, consisting of approximately 50 % topsoil, 25 % compost or peat, and 25% native soil. Planting soil shall be loose, friable, and free from refuse, stumps, roots, brush, weeds, rocks and stones 2 inches (50 millimeters) in diameter. In addition, the material shall be free from any material that will prevent proper development and plant growth.

- (a) For ericaceous plants and broad-leaved evergreens requiring an acid soil, planting soil shall have a true pH of 4.5 to 5.5. If it has not, it shall be amended by the Contractor at his own expense to the proper pH range by mixing with sulphur.
- (b) Planting soil for general planting of nonacid-loving plants shall have a true pH value of 5.6 to 6.5. If it has not, it shall be amended by the Contractor at his own expense to the proper pH range by mixing with dolomitic limestone.

The amount of either sulphur or limestone required to adjust the planting soil to the proper pH range (above) shall be determined by the Engineer based on agronomic tests. The limestone shall conform to the requirements of Article M.13.02. The sulphur shall be commercial or flour sulphur, unadulterated, and shall be delivered in containers with the name of the manufacturer, material, analysis, and net weight (mass) appearing on each container.

The Engineer reserves the right to draw such samples and to perform such tests as he deems necessary to ensure that these specifications are met.”

M.13.03 – Fertilizer:

In the last sentence of the first paragraph change “AOAC International.” to “AOAC.”

M.13.04 – Seed Mixture:

Replace Subarticle (a) with the following:

“(a) The grass seed mixture shall conform to the following:

<u>Species</u>	<u>Proportion By Weight (Mass) Pounds (kilograms)</u>	<u>Minimum Purity (Percent)</u>	<u>Minimum Germination (Percent)</u>
VELVET BENTGRASS, (<u>AGROSTIS CANINA</u>) CERTIFIED VARIETY: OR EQUAL CERTIFIED VARIETY;	25 (9.1)	96	85
RED FESCUE (<u>FESTUCA RUBRA L. SSP. RUBRA</u>) CERTIFIED VARIETY: OR EQUAL CERTIFIED VARIETY	35 (15.9)	97	80
PARTRIDGE PEA (<u>CHAMAECRISTA FASCICULATA</u>) CERTIFIED VARIETY	10 (4.5)	95	90
INDIAN GRASS (<u>SORGHASTRUM NUTANS</u>) CERTIFIED VARIETY:	15 (5.45)	95	90
CANADA WILD RYE (<u>ELYMUS CANADENSIS</u>) CERTIFIED VARIETY:	5 (2.3)	95	90
KENTUCKY BLUE GRASS (<u>POA PRATENSIS</u>) CERTIFIED VARIETY:	10 (4.5)	95	90

Under no circumstances should annual Ryegrass, Italian Rye, or any other seed be added to the seed mixture.”

M.13.06 – Compost:

In the third to last sentence, replace “DEP” with “DEEP”.

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION M.16
TRAFFIC CONTROL SIGNALS**

M.16.04 – Poles:

1. Steel Poles:

(i) Wire Entrance Fitting:

In the second sentence, delete “required to accept the cables”.

M.16.06 – Traffic Signals:

9. Painting:

In the first sentence, replace “MIL” with “MILSPEC”.

Subsection **Third Coat:**

Replace the first two sentences with the following:

“Dark Green Enamel: Shall be Dark Green exterior baked enamel and shall comply with FS A-A 2962. The color shall be No. 14056, FS No. 595.”

and in the third sentence replace “MIL” with “MILSPEC”.

M.16.08 – Pedestrian Push Button

In the last sentence of the second paragraph, change “Americans With Disabilities Act (ADA)” to “ADA”.

Subarticle **Painting**

Subsection **Third Coat:**

Delete the entire paragraph and replace it with the following:

“**Third Coat:** Dark Green Enamel, shall be DARK GREEN exterior-baking enamel and shall comply with Federal Specifications A-A 2962. The color shall be No. 14056, Federal Standard No. 595.”

M.16.10 – Flasher Cabinet:

1. Cabinet:

In subsection (f), change “Underwriter’s Laboratory” to “UL”.

M.16.15 – Messenger and Span Wire:

Delete the entire article and replace it with the following:

“M.16.15 – Messenger and Span Wire: The materials for this work shall conform to the following requirements:

1. Messenger wire shall be made of double-galvanized 7-strand utilities-grade steel wire cable, not less than 3/16 inch (4.8 millimeters) in diameter, with at least a 2,400-pound (10.7-kilonewton) breaking strength.
2. Span wire:
 - (a) “Span wire” shall be made of double-galvanized 7-strand utilities-grade steel wire cable, not less than 3/8 inch (9.5 millimeters) in diameter, with at least an 11,200-pound (50-kilonewton) breaking strength.
 - (b) “Span wire (high strength)” shall be made of double-galvanized 7-strand extra-high-strength-grade steel wire cable, not less than 7/16 inch (11.1 millimeters) in diameter, with at least a 20,800-pound (94-kilonewton) breaking strength.
3. All hardware accessories shown on the plans to be used in span wire or messenger mounting shall be made of high-strength, double-galvanized, first-quality materials.”

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION M.17
ELASTOMERIC MATERIALS**

M.17.01 – Elastomeric Bearing Pads:

2. Laminae:

In the last sentence of Subsection (a), replace “AAA 6061-T6” with “AA 6061-T6”.

4. Adhesive for Bonding:

In the 2nd paragraph of Subsection (b), replace “MS MIL” with “MILSPEC”.

**CONNECTICUT
SUPPLEMENTAL SPECIFICATION
SECTION M.18
SIGNING**

In the list of Articles, change “M.18.09—Reflective Sheeting” to “M18.09—Retroreflective Sheeting”

M.18.07—Delineators:

1. Reflectors:

In the first sentence of the first paragraph, change “reflective” to “retroreflective.”

In the only sentence of the second paragraph, change “reflective” to “retroreflective.”

M.18.09—Reflective Sheeting:

Delete the entire article and replace with the following:

“M.18.09—Retroreflective Sheeting: Retroreflective sheeting materials shall appear on the Department's Qualified Product List for the application intended and shall be in accordance with ASTM D4956.”

M.18.10—Demountable Copy:

2. Type III Reflective Sheeting

Change the title from “Type III Reflective Sheeting” to “Type IV Retroreflective Sheeting.”

In the first sentence of the first paragraph, change “reflective” to “retroreflective.”

In the second sentence of the first paragraph, change “reflective” to “retroreflective” and change “Section M.18.09.01” to “Article M.18.09.”

3. Non-Reflective Plastic Sheeting:

H. Solvent and Chemical Resistance:

In the chart under this subsection, replace “MIL” with “MILSPEC.”

M.18.15—Sign-Mounting Bolts:

Delete the entire article and replace with the following:

“M.18.15—Sign-Mounting Bolts: Bolts used for sign-mounting shall be stainless steel and meet the requirements of ASTM F593, Group 1 or 2 (Alloy Types 304 or 316). Locking nuts shall be stainless steel and shall meet the requirements of ASTM F594, Group 1 or 2 (Alloy Types 304 or 316). Washers shall also be stainless steel and shall meet the requirements of ASTM A240 (Alloy Types 304 or 316).”

Construction Contracts - Required Contract Provisions (State Funded Only Contracts)

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2. Contractor Work Force Utilization / Specific Equal Employment Opportunity
3. Contract Wage Rates
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 - a. Construction, Alteration or Repair of Public Works Projects; Wage Rates
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- EXHIBIT A – Title VI Contractor Assurances (page 13)
- EXHIBIT B – Contractor Work Force Utilization / Equal Employment Opportunity (page 14)
- EXHIBIT C – Health Insurance Portability and Accountability Act of 1996 (HIPAA) (page 17)
- EXHIBIT D - Campaign Contribution Restriction (page 25)
- EXHIBIT E - State Wage Rates (Attached at the end)

1. Title VI of the Civil Rights Act of 1964 / Nondiscrimination Requirements

The Contractor shall comply with Title VI of the Civil Rights Act of 1964 as amended (42 U.S.C. 2000 et seq.), all requirements imposed by the regulations of the United States Department of Transportation (49 CFR Part 21) issued in implementation thereof, and the Title VI Contractor Assurances attached hereto at Exhibit A, all of which are hereby made a part of this Contract.

2. Contractor Work Force Utilization / Equal Employment Opportunity

- (a) The Contractor shall comply with the Contractor Work Force Utilization / Equal Employment Opportunity requirements attached at Exhibit B and hereby made part of this Contract, whenever a contractor or subcontractor at any tier performs construction work in excess of \$10,000. These goals shall be included in each contract and subcontract. Goal achievement is calculated for each trade using the hours worked under each trade.
- (b) Companies with contracts, agreements or purchase orders valued at \$10,000 or more will develop and implement an Affirmative Action Plan utilizing the ConnDOT Affirmative Action Plan Guideline. This Plan shall be designed to further the provision of equal employment opportunity to all persons without regard to their race, color, religion, sex or national origin, and to promote the full realization of equal employment opportunity through a positive continuation program. Plans shall be updated as required by ConnDOT.

3. Contract Wage Rates

The Contractor shall comply with:

The State wage rate requirements indicated in Exhibit E hereof are hereby made part of this Contract.

Prevailing Wages for Work on State Highways; Annual Adjustments. With respect to contracts for work on state highways and bridges on state highways, the Contractor shall comply with the provisions of Section 31-54 and 31-55a of the Connecticut General Statutes, as revised.

As required by section 1.05.12 (Payrolls) of the State of Connecticut, Department of Transportation's Standard Specification for Roads, Bridges and Incidental Construction (FORM 816), as may be revised, every Contractor or subcontractor performing project work on a federal aid project is required to post the relevant prevailing wage rates as determined by the United States Secretary of Labor. The wage rate determinations shall be posted in prominent and easily accessible places at the work site.

4. Americans with Disabilities Act of 1990, as Amended

This provision applies to those Contractors who are or will be responsible for compliance with the terms of the Americans with Disabilities Act of 1990, as amended (42 U.S.C. 12101 et seq.), (Act), during the term of the Contract. The Contractor represents that it is familiar with the terms of this Act and that it is in compliance with the Act. Failure of the Contractor to satisfy this standard as the same applies to performance under this Contract, either now or during the term of the Contract as it may be amended, will render the Contract voidable at the option of the State upon notice to the contractor. The Contractor warrants that it will hold the State harmless and indemnify the State from any liability which may be imposed upon the State as a result of any failure of the Contractor to be in compliance with this Act, as the same applies to performance under this Contract.

5. Connecticut Statutory Labor Requirements

(a) Construction, Alteration or Repair of Public Works Projects; Wage Rates. The Contractor shall comply with Section 31-53 of the Connecticut General Statutes, as revised. The wages paid on an hourly basis to any person performing the work of any mechanic, laborer or worker on the work herein contracted to be done and the amount of payment or contribution paid or payable on behalf of each such person to any employee welfare fund, as defined in subsection (i) of section 31-53 of the Connecticut General Statutes, shall be at a rate equal to the rate customary or prevailing for the same work in the same trade or occupation in the town in which such public works project is being constructed. Any contractor who is not obligated by agreement to make payment or contribution on behalf of such persons to any such employee welfare fund shall pay to each mechanic, laborer or worker as part of such person's wages the amount of payment or contribution for such person's classification on each pay day.

(b) Debarment List. Limitation on Awarding Contracts. The Contractor shall comply with Section 31-53a of the Connecticut General Statutes, as revised.

(c) Construction Safety and Health Course. The Contractor shall comply with section 31-53b of the Connecticut General Statutes, as revised. The contractor shall furnish proof to the Labor Commissioner with the weekly certified payroll form for the first week each employee begins work on such project that any person performing the work of a mechanic, laborer or worker pursuant to the classifications of labor under section 31-53 of the Connecticut General Statutes, as revised, on such public works project, pursuant to such contract, has completed a course of at least ten hours in duration in construction safety and health approved by the federal Occupational Safety and Health Administration or, has completed a new miner training program approved by the Federal Mine Safety and Health Administration in accordance with 30 CFR 48 or, in the case of telecommunications employees, has completed at least ten hours of training in accordance with 29 CFR 1910.268.

Any employee required to complete a construction safety and health course as required that has not completed the course, shall have a maximum of fourteen (14) days to complete the course. If the employee has not been brought into compliance, they shall be removed from the project until such time as they have completed the required training.

Any costs associated with this notice shall be included in the general cost of the contract. In addition, there shall be no time granted to the contractor for compliance with this notice. The contractor's compliance with this notice and any associated regulations shall not be grounds for claims as outlined in Section 1.11 – "Claims".

(d) Awarding of Contracts to Occupational Safety and Health Law Violators Prohibited. The Contract is subject to Section 31-57b of the Connecticut General Statutes, as revised.

(e) Residents Preference in Work on Other Public Facilities. NOT APPLICABLE TO FEDERAL AID CONTRACTS. Pursuant to Section 31-52a of the Connecticut General Statutes, as revised, in the employment of mechanics, laborers or workmen to perform the work specified herein, preference shall be given to residents of the state who are, and continuously for at least six months prior to the date hereof have been, residents of this state, and if no such person is available, then to residents of other states

6. Tax Liability - Contractor's Exempt Purchase Certificate (CERT – 141)

The Contractor shall comply with Chapter 219 of the Connecticut General Statutes pertaining to tangible personal property or services rendered that is/are subject to sales tax. The Contractor is responsible for determining its tax liability. If the Contractor purchases materials or supplies pursuant to the Connecticut Department of Revenue Services' "Contractor's Exempt Purchase Certificate (CERT-141)," as may be revised, the Contractor acknowledges and agrees that title to such materials and supplies installed or placed in the project will vest in the State simultaneously with passage of title from the retailers or vendors thereof, and the Contractor will have no property rights in the materials and supplies purchased.

Forms and instructions are available anytime by:

Internet: Visit the DRS website at www.ct.gov/DRS to download and print Connecticut tax forms; or
Telephone: Call 1-800-382-9463 (Connecticut calls outside the Greater Hartford calling area only) and select Option 2 or call 860-297-4753 (from anywhere).

7. Executive Orders

This contract is subject to the provisions of Executive Order No. Three of Governor Thomas J. Meskill, promulgated June 16, 1971, concerning labor employment practices, Executive Order No. Seventeen of Governor Thomas J. Meskill, promulgated February 15, 1973, concerning the listing of employment openings and Executive Order No. Sixteen of Governor John G. Rowland promulgated August 4, 1999, concerning violence in the workplace, all of which are incorporated into and are made a part of the contract as if they had been fully set forth in it. The contract may also be subject to Executive Order No. 14 of Governor M. Jodi Rell, promulgated April 17, 2006, concerning procurement of cleaning products and services and to Executive Order No. 49 of Governor Dannel P. Malloy, promulgated May 22, 2015, mandating disclosure of certain gifts to public employees and contributions to certain candidates for office. If Executive Order No. 14 and/or Executive Order No. 49 are applicable, they are deemed to be incorporated into and are made a part of the contract as if they had been fully set forth in it. At the Contractor's request, the Department shall provide a copy of these orders to the Contractor.

8. Non Discrimination Requirement (pursuant to section 4a-60 and 4a-60a of the Connecticut General Statutes, as revised): References to "minority business enterprises" in this Section are not applicable to Federal-aid projects/contracts. Federal-aid projects/contracts are instead subject to the Federal Disadvantaged Business Enterprise Program.

(a) For purposes of this Section, the following terms are defined as follows:

- i. "Commission" means the Commission on Human Rights and Opportunities;
- ii. "Contract" and "contract" include any extension or modification of the Contract or contract;
- iii. "Contractor" and "contractor" include any successors or assigns of the Contractor or contractor;
- iv. "gender identity or expression" means a person's gender-related identity, appearance or behavior, whether or not that gender-related identity, appearance or behavior is different from that traditionally associated with the person's physiology or assigned sex at birth, which gender-related identity can be shown by providing evidence including, but not limited to, medical history, care or treatment of the gender-related identity, consistent and uniform assertion of the gender-related identity or any other evidence that the gender-related identity is sincerely held, part of a person's core identity or not being asserted for an improper purpose.

- v. "good faith" means that degree of diligence which a reasonable person would exercise in the performance of legal duties and obligations;
- vi. "good faith efforts" shall include, but not be limited to, those reasonable initial efforts necessary to comply with statutory or regulatory requirements and additional or substituted efforts when it is determined that such initial efforts will not be sufficient to comply with such requirements;
- vii. "marital status" means being single, married as recognized by the State of Connecticut, widowed, separated or divorced;
- viii. "mental disability" means one or more mental disorders, as defined in the most recent edition of the American Psychiatric Association's "Diagnostic and Statistical Manual of Mental Disorders", or a record of or regarding a person as having one or more such disorders;
- ix. "minority business enterprise" means any small contractor or supplier of materials fifty-one percent or more of the capital stock, if any, or assets of which is owned by a person or persons: (1) who are active in the daily affairs of the enterprise, (2) who have the power to direct the management and policies of the enterprise, and (3) who are members of a minority, as such term is defined in subsection (a) of Connecticut General Statutes § 32-9n; and
- x. "public works contract" means any agreement between any individual, firm or corporation and the State or any political subdivision of the State other than a municipality for construction, rehabilitation, conversion, extension, demolition or repair of a public building, highway or other changes or improvements in real property, or which is financed in whole or in part by the State, including, but not limited to, matching expenditures, grants, loans, insurance or guarantees.

For purposes of this Section, the terms "Contract" and "contract" do not include a contract where each contractor is (1) a political subdivision of the State, including, but not limited to, a municipality, (2) a quasi-public agency, as defined in Conn. Gen. Stat. Section 1-120, (3) any other state, including but not limited to any federally recognized Indian tribal governments, as defined in Conn. Gen. Stat. Section 1-267, (4) the federal government, (5) a foreign government, or (6) an agency of a subdivision, agency, state or government described in the immediately preceding enumerated items (1), (2), (3), (4) or (5).

- (b) (1) The Contractor agrees and warrants that in the performance of the Contract such Contractor will not discriminate or permit discrimination against any person or group of persons on the grounds of race, color, religious creed, age, marital status, national origin, ancestry, sex, gender identity or expression, intellectual disability, mental disability or physical disability, including, but not limited to, blindness, unless it is shown by such Contractor that such disability prevents performance of the work involved, in any manner prohibited by the laws of the United States or of the State of Connecticut; and the Contractor further agrees to take affirmative action to insure that applicants with job-related qualifications are employed and that employees are treated when employed without regard to their race, color, religious creed, age, marital status, national origin, ancestry, sex, gender identity or expression, intellectual disability, mental disability or physical disability, including, but not limited to, blindness, unless it is shown by the Contractor that such disability prevents performance of the work involved; (2) the Contractor agrees, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, to state that it is an "affirmative action-equal opportunity employer" in accordance with regulations adopted by the Commission; (3) the Contractor agrees to provide each labor union or representative of workers with which the Contractor has a collective bargaining Agreement or other contract or understanding and each vendor with which the Contractor has a contract or

understanding, a notice to be provided by the Commission, advising the labor union or workers' representative of the Contractor's commitments under this section and to post copies of the notice in conspicuous places available to employees and applicants for employment; (4) the Contractor agrees to comply with each provision of this Section and Connecticut General Statutes §§ 46a-68e and 46a-68f and with each regulation or relevant order issued by said Commission pursuant to Connecticut General Statutes §§ 46a-56, 46a-68e and 46a-68f; and (5) the Contractor agrees to provide the Commission on Human Rights and Opportunities with such information requested by the Commission, and permit access to pertinent books, records and accounts, concerning the employment practices and procedures of the Contractor as relate to the provisions of this Section and Connecticut General Statutes § 46a-56. If the contract is a public works contract, the Contractor agrees and warrants that he will make good faith efforts to employ minority business enterprises as subcontractors and suppliers of materials on such public works projects.

- (c) Determination of the Contractor's good faith efforts shall include, but shall not be limited to, the following factors: The Contractor's employment and subcontracting policies, patterns and practices; affirmative advertising, recruitment and training; technical assistance activities and such other reasonable activities or efforts as the Commission may prescribe that are designed to ensure the participation of minority business enterprises in public works projects.
- (d) The Contractor shall develop and maintain adequate documentation, in a manner prescribed by the Commission, of its good faith efforts.
- (e) The Contractor shall include the provisions of subsection (b) of this Section in every subcontract or purchase order entered into in order to fulfill any obligation of a contract with the State and such provisions shall be binding on a subcontractor, vendor or manufacturer unless exempted by regulations or orders of the Commission. The Contractor shall take such action with respect to any such subcontract or purchase order as the Commission may direct as a means of enforcing such provisions including sanctions for noncompliance in accordance with Connecticut General Statutes §46a-56; provided if such Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the Commission, the Contractor may request the State of Connecticut to enter into any such litigation or negotiation prior thereto to protect the interests of the State and the State may so enter.
- (f) The Contractor agrees to comply with the regulations referred to in this Section as they exist on the date of this Contract and as they may be adopted or amended from time to time during the term of this Contract and any amendments thereto.
- (g) (1) The Contractor agrees and warrants that in the performance of the Contract such Contractor will not discriminate or permit discrimination against any person or group of persons on the grounds of sexual orientation, in any manner prohibited by the laws of the United States or the State of Connecticut, and that employees are treated when employed without regard to their sexual orientation; (2) the Contractor agrees to provide each labor union or representative of workers with which such Contractor has a collective bargaining Agreement or other contract or understanding and each vendor with which such Contractor has a contract or understanding, a notice to be provided by the Commission on Human Rights and Opportunities advising the labor union or workers' representative of the Contractor's commitments under this section, and to post copies of the notice in conspicuous places available to employees and applicants for employment; (3) the Contractor agrees to comply with each provision of this section and with each regulation or relevant order issued by said Commission pursuant to Connecticut General Statutes § 46a-56;

and (4) the Contractor agrees to provide the Commission on Human Rights and Opportunities with such information requested by the Commission, and permit access to pertinent books, records and accounts, concerning the employment practices and procedures of the Contractor which relate to the provisions of this Section and Connecticut General Statutes § 46a-56.

- (h) The Contractor shall include the provisions of the foregoing paragraph in every subcontract or purchase order entered into in order to fulfill any obligation of a contract with the State and such provisions shall be binding on a subcontractor, vendor or manufacturer unless exempted by regulations or orders of the Commission. The Contractor shall take such action with respect to any such subcontract or purchase order as the Commission may direct as a means of enforcing such provisions including sanctions for noncompliance in accordance with Connecticut General Statutes § 46a-56; provided, if such Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the Commission, the Contractor may request the State of Connecticut to enter into any such litigation or negotiation prior thereto to protect the interests of the State and the State may so enter.”

The Nondiscrimination Certifications can be found at the Office of Policy and Management website.

<http://www.ct.gov/opm/cwp/view.asp?a=2982&Q=390928>

9. Whistleblower Provision

The following clause is applicable if the Contract has a value of Five Million Dollars (\$5,000,000) or more.

Whistleblowing. This Contract may be subject to the provisions of Section 4-61dd of the Connecticut General Statutes. In accordance with this statute, if an officer, employee or appointing authority of the Contractor takes or threatens to take any personnel action against any employee of the Contractor in retaliation for such employee's disclosure of information to any employee of the contracting state or quasi-public agency or the Auditors of Public Accounts or the Attorney General under the provisions of subsection (a) of such statute, the Contractor shall be liable for a civil penalty of not more than five thousand dollars for each offense, up to a maximum of twenty per cent of the value of this Contract. Each violation shall be a separate and distinct offense and in the case of a continuing violation, each calendar day's continuance of the violation shall be deemed to be a separate and distinct offense. The State may request that the Attorney General bring a civil action in the Superior Court for the Judicial District of Hartford to seek imposition and recovery of such civil penalty. In accordance with subsection (f) of such statute, each large state contractor, as defined in the statute, shall post a notice of the provisions of the statute relating to large state contractors in a conspicuous place which is readily available for viewing by the employees of the Contractor.

10. Connecticut Freedom of Information Act

- (a) **Disclosure of Records.** This Contract may be subject to the provisions of section 1-218 of the Connecticut General Statutes. In accordance with this statute, each contract in excess of two million five hundred thousand dollars between a public agency and a person for the performance of a governmental function shall (a) provide that the public agency is entitled to receive a copy of records and files related to the performance of the governmental function, and (b) indicate that such records and files are subject to FOIA and may be disclosed by the public agency pursuant to FOIA. No request to inspect or copy such records or files shall be valid unless the request is made to the public agency in accordance with FOIA. Any complaint by a person who is denied the right to inspect or copy such records or files shall be brought to the Freedom of Information Commission in accordance with the provisions of sections 1-205 and 1-206 of the Connecticut General Statutes.

(b) Confidential Information. The State will afford due regard to the Contractor's request for the protection of proprietary or confidential information which the State receives from the Contractor. However, all materials associated with the Contract are subject to the terms of the FOIA and all corresponding rules, regulations and interpretations. In making such a request, the Contractor may not merely state generally that the materials are proprietary or confidential in nature and not, therefore, subject to release to third parties. Those particular sentences, paragraphs, pages or sections that the Contractor believes are exempt from disclosure under the FOIA must be specifically identified as such. Convincing explanation and rationale sufficient to justify each exemption consistent with the FOIA must accompany the request. The rationale and explanation must be stated in terms of the prospective harm to the competitive position of the Contractor that would result if the identified material were to be released and the reasons why the materials are legally exempt from release pursuant to the FOIA. To the extent that any other provision or part of the Contract conflicts or is in any way inconsistent with this section, this section controls and shall apply and the conflicting provision or part shall not be given effect. If the Contractor indicates that certain documentation is submitted in confidence, by specifically and clearly marking the documentation as "CONFIDENTIAL," DOT will first review the Contractor's claim for consistency with the FOIA (that is, review that the documentation is actually a trade secret or commercial or financial information and not required by statute), and if determined to be consistent, will endeavor to keep such information confidential to the extent permitted by law. See, *e.g.*, Conn. Gen. Stat. §1-210(b)(5)(A-B). The State, however, has no obligation to initiate, prosecute or defend any legal proceeding or to seek a protective order or other similar relief to prevent disclosure of any information that is sought pursuant to a FOIA request. Should the State withhold such documentation from a Freedom of Information requester and a complaint be brought to the Freedom of Information Commission, the Contractor shall have the burden of cooperating with DOT in defense of that action and in terms of establishing the availability of any FOIA exemption in any proceeding where it is an issue. In no event shall the State have any liability for the disclosure of any documents or information in its possession which the State believes are required to be disclosed pursuant to the FOIA or other law.

11. Service of Process

The Contractor, if not a resident of the State of Connecticut, or, in the case of a partnership, the partners, if not residents, hereby appoints the Secretary of State of the State of Connecticut, and his successors in office, as agent for service of process for any action arising out of or as a result of this Contract; such appointment to be in effect throughout the life of this Contract and six (6) years thereafter.

12. Substitution of Securities for Retainages on State Contracts and Subcontracts

This Contract is subject to the provisions of Section 3-112a of the General Statutes of the State of Connecticut, as revised.

13. Health Insurance Portability and Accountability Act of 1996 (HIPAA)

The Contractor shall comply, if applicable, with the Health Insurance Portability and Accountability Act of 1996 and, pursuant thereto, the provisions attached at Exhibit C, and hereby made part of this Contract.

14. Forum and Choice of Law

Forum and Choice of Law. The parties deem the Contract to have been made in the City of Hartford, State of Connecticut. Both parties agree that it is fair and reasonable for the validity and construction of the Contract to be, and it shall be, governed by the laws and court decisions of the State of Connecticut, without giving effect to its principles of conflicts of laws. To the extent that any immunities provided by Federal law or the laws of the State of Connecticut do not bar an action against the State, and to the extent that these courts are courts of competent jurisdiction, for the purpose of venue, the complaint shall be made returnable to the Judicial District of Hartford only or shall be brought in the United States District Court for the District of Connecticut only, and shall not be transferred to any other court, provided, however, that nothing here constitutes a waiver or compromise of the sovereign immunity of the State of Connecticut. The Contractor waives any objection which it may now have or will have to the laying of venue of any Claims in any forum and further irrevocably submits to such jurisdiction in any suit, action or proceeding.

15. Summary of State Ethics Laws

Pursuant to the requirements of section 1-101qq of the Connecticut General Statutes, the summary of State ethics laws developed by the State Ethics Commission pursuant to section 1-81b of the Connecticut General Statutes is incorporated by reference into and made a part of the Contract as if the summary had been fully set forth in the Contract.

16. Audit and Inspection of Plants, Places of Business and Records

- (a) The State and its agents, including, but not limited to, the Connecticut Auditors of Public Accounts, Attorney General and State's Attorney and their respective agents, may, at reasonable hours, inspect and examine all of the parts of the Contractor's and Contractor Parties' plants and places of business which, in any way, are related to, or involved in, the performance of this Contract. For the purposes of this Section, "Contractor Parties" means the Contractor's members, directors, officers, shareholders, partners, managers, principal officers, representatives, agents, servants, consultants, employees or any one of them or any other person or entity with whom the Contractor is in privity of oral or written contract and the Contractor intends for such other person or entity to Perform under the Contract in any capacity.
- (b) The Contractor shall maintain, and shall require each of the Contractor Parties to maintain, accurate and complete Records. The Contractor shall make all of its and the Contractor Parties' Records available at all reasonable hours for audit and inspection by the State and its agents.
- (c) The State shall make all requests for any audit or inspection in writing and shall provide the Contractor with at least twenty-four (24) hours' notice prior to the requested audit and inspection date. If the State suspects fraud or other abuse, or in the event of an emergency, the State is not obligated to provide any prior notice.
- (d) The Contractor shall keep and preserve or cause to be kept and preserved all of its and Contractor Parties' Records until three (3) years after the latter of (i) final payment under this Agreement, or (ii) the expiration or earlier termination of this Agreement, as the same may be modified for any reason. The State may request an audit or inspection at any time during this period. If any Claim or audit is started before the expiration of this period, the Contractor shall retain or cause to be retained all Records until all Claims or audit findings have been resolved.
- (e) The Contractor shall cooperate fully with the State and its agents in connection with an audit or inspection. Following any audit or inspection, the State may conduct and the Contractor shall cooperate with an exit conference.
- (f) The Contractor shall incorporate this entire Section verbatim into any contract or other agreement that it enters into with any Contractor Party.

17. Campaign Contribution Restriction

For all State contracts, defined in Conn. Gen. Stat. §9-612(f)(1) as having a value in a calendar year of \$50,000 or more, or a combination or series of such agreements or contracts having a value of \$100,000 or more, the authorized signatory to this contract expressly acknowledges receipt of the State Elections Enforcement Commission's notice advising state contractors of state campaign contribution and solicitation prohibitions, and will inform its principals of the contents of the notice, as set forth in "Notice to Executive Branch State Contractors and Prospective State Contractors of Campaign Contribution and Solicitation Limitations," a copy of which is attached hereto and hereby made a part of this contract, attached as Exhibit D.

18. Tangible Personal Property

- (a) The Contractor on its behalf and on behalf of its Affiliates, as defined below, shall comply with the provisions of Conn. Gen. Stat. §12-411b, as follows:
- (1) For the term of the Contract, the Contractor and its Affiliates shall collect and remit to the State of Connecticut, Department of Revenue Services, any Connecticut use tax due under the provisions of Chapter 219 of the Connecticut General Statutes for items of tangible personal property sold by the Contractor or by any of its Affiliates in the same manner as if the Contractor and such Affiliates were engaged in the business of selling tangible personal property for use in Connecticut and had sufficient nexus under the provisions of Chapter 219 to be required to collect Connecticut use tax;
 - (2) A customer's payment of a use tax to the Contractor or its Affiliates relieves the customer of liability for the use tax;
 - (3) The Contractor and its Affiliates shall remit all use taxes they collect from customers on or before the due date specified in the Contract, which may not be later than the last day of the month next succeeding the end of a calendar quarter or other tax collection period during which the tax was collected;
 - (4) The Contractor and its Affiliates are not liable for use tax billed by them but not paid to them by a customer; and
 - (5) Any Contractor or Affiliate who fails to remit use taxes collected on behalf of its customers by the due date specified in the Contract shall be subject to the interest and penalties provided for persons required to collect sales tax under chapter 219 of the general statutes.
- (b) For purposes of this section of the Contract, the word "Affiliate" means any person, as defined in section 12-1 of the general statutes, that controls, is controlled by, or is under common control with another person. A person controls another person if the person owns, directly or indirectly, more than ten per cent of the voting securities of the other person. The word "voting security" means a security that confers upon the holder the right to vote for the election of members of the board of directors or similar governing body of the business, or that is convertible into, or entitles the holder to receive, upon its exercise, a security that confers such a right to vote. "Voting security" includes a general partnership interest.
- (c) The Contractor represents and warrants that each of its Affiliates has vested in the Contractor plenary authority to so bind the Affiliates in any agreement with the State of Connecticut. The Contractor on its own behalf and on behalf of its Affiliates shall also provide, no later than 30 days after receiving a request by the State's contracting authority, such information as the State may require to ensure, in the State's sole determination, compliance with the provisions of Chapter 219 of the Connecticut General Statutes, including, but not limited to, §12-411b.

19. Bid Rigging and/or Fraud – Notice to Contractor

The Connecticut Department of Transportation is cooperating with the U.S. Department of Transportation and the Justice Department in their investigation into highway construction contract bid rigging and/or fraud.

A toll-free “HOT LINE” telephone number 800-424-9071 has been established to receive information from contractors, subcontractors, manufacturers, suppliers or anyone with knowledge of bid rigging and/or fraud, either past or current. The “HOT LINE” telephone number will be available during normal working hours (8:00 am – 5:00 pm EST). Information will be treated confidentially and anonymity respected.

20. Consulting Agreement Affidavit

The Contractor shall comply with Connecticut General Statutes Section 4a-81(a) and 4a-81(b), as revised. Pursuant to Public Act 11-229, after the initial submission of the form, if there is a change in the information contained in the form, a contractor shall submit the updated form, as applicable, either (i) not later than thirty (30) days after the effective date of such change or (ii) prior to execution of any new contract, whichever is earlier.

The Affidavit/Form may be submitted in written format or electronic format through the Department of Administrative Services (DAS) website.

EXHIBIT A

TITLE VI CONTRACTOR ASSURANCES

During the performance of this Contract, the contractor, for itself, its assignees and successors in interest (hereinafter referred to as the "Contractor") agrees as follows:

1. Compliance with Regulations: The Contractor shall comply with the regulations relative to nondiscrimination in federally assisted programs of the United States Department of Transportation (hereinafter, "USDOT"), Title 49, Code of Federal Regulations, Part 21, as they may be amended from time to time (hereinafter referred to as the "Regulations"), which are herein incorporated by reference and made a part of this contract.

2. Nondiscrimination: The Contractor, with regard to the work performed by it during the Contract, shall not discriminate on the grounds of race, color, national origin, sex, age, or disability in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The Contractor shall not participate either directly or indirectly in the discrimination prohibited by Subsection 5 of the Regulations, including employment practices when the Contract covers a program set forth in Appendix B of the Regulations.

3. Solicitations for Subcontracts, Including Procurements of Materials and Equipment:

In all solicitations either by competitive bidding or negotiation made by the Contractor for work to be performed under a subcontract, including procurements of materials or leases of equipment, each potential subcontractor or supplier shall be notified by the Contractor of the Contractor's obligations under this contract and the Regulations relative to nondiscrimination on the grounds of race, color, national origin, sex, age, or disability.

4. Information and Reports: The Contractor shall provide all information and reports required by the Regulations or directives issued pursuant thereto and shall permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the Connecticut Department of Transportation (ConnDOT) or the Funding Agency (FHWA, FTA and FAA) to be pertinent to ascertain compliance with such Regulations, orders, and instructions. Where any information required of a Contractor is in the exclusive possession of another who fails or refuses to furnish this information, the Contractor shall so certify to ConnDOT or the Funding Agency, as appropriate, and shall set forth what efforts it has made to obtain the information.

5. Sanctions for Noncompliance: In the event of the Contractor's noncompliance with the nondiscrimination provisions of this Contract, the ConnDOT shall impose such sanctions as it or the Funding Agency may determine to be appropriate, including, but not limited to:

- A. Withholding contract payments until the Contractor is in-compliance; and/or
- B. Cancellation, termination, or suspension of the Contract, in whole or in part.

6. Incorporation of Provisions: The Contractor shall include the provisions of paragraphs 1 through 5 in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Regulations or directives issued pursuant thereto. The Contractor shall take such action with respect to any subcontract or procurement as the ConnDOT or the Funding Agency may -direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, however, that in the event a Contractor becomes involved in, or is threatened with, litigation with a subcontractor or supplier as a result of such direction, the Contractor may request the ConnDOT to enter into such litigation to protect the interests of the Funding Agency, and, in addition, the Contractor may request the United States to enter into such litigation to protect the interests of the United States

EXHIBIT B**CONTRACTOR WORKFORCE UTILIZATION / EQUAL EMPLOYMENT OPPORTUNITY****1. Project Workforce Utilization Goals:**

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or Federally assisted or funded) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for the geographical area where the work is actually performed.

Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of \$10,000 the provisions of these specifications which contain the applicable goals for minority and female participation.

The goals for minority and female utilization are expressed in percentage terms for the contractor's aggregate work-force in each trade on all construction work in the covered area, are referenced in the Appendix A below.

STATE FUNDED PROJECTS (only)**APPENDIX A****(Labor Market Goals)****LABOR MARKET AREA GOAL**
Female**Minority**

Bridgeport				14%
6.9%				
Ansonia	Beacon Falls	Bridgeport	Derby	
Easton	Fairfield	Milford	Monroe	
Oxford	Seymour	Shelton	Stratford	
Trumbull				
Danbury				4%
6.9%				
Bethel	Bridgewater	Brookfield	Danbury	
Kent	New Fairfield	New Milford	Newtown	
Redding	Ridgefield	Roxbury	Sherman	
Washington				
Danielson				2%
6.9%				
Brooklyn	Eastford	Hampton	Killingly	
Pomfret	Putnam	Scotland	Sterling	
Thompson	Voluntown	Union	Woodstock	
Hartford				15%
6.9%				

Andover	Ashford	Avon	Barkhamsted
Belin	Bloomfield	Bolton	Bristol
Burlington	Canton	Chaplin	Colchester
Columbia	Coventry	Cromwell	Durham
East Granby	East Haddam	East Hampton	East Hartford
East Windsor	Ellington	Enfield	Farmington
Glastonbury	Granby	Haddam	Hartford
Harwinton	Hebron	Lebanon	Manchester
Mansfield	Marlborough	Middlefield	Middletown
Newington	Plainville	Plymouth	Portland
Rocky Hill	Simsbury	Somers	South Windsor
Southington	Stafford	Suffield	Tolland
Vernon	West Hartford	Wethersfield	Willington
Winchester	Windham	Windsor	Windsor Locks

Lower River	2%
6.9%	

Chester	Deep River	Essex	Old Lyme
Westbrook			

New Haven	14%
6.9%	

Bethany	Branford	Cheshire	Clinton
East Haven	Guilford	Hamden	Killingworth
Madison	Meriden	New Haven	North Branford
North Haven	Orange	Wallingford	West Haven
Woodbridge			

New London	8%
6.9%	

Bozrah	Canterbury	East Lyme	Franklin
Griswold	Groton	Ledyard	Lisbon
Montville	New London	North Stonington	Norwich
Old Lyme	Old Saybrook	Plainfield	Preston
Salem	Sprague	Stonington	Waterford
Hopkinton	RI – Westerly Rhode Island		

Stamford	17%
6.9%	

Darien	Greenwich	New Canaan	Norwalk
Stamford	Weston	Westport	Wilton

Torrington	2%
6.9%	

Canaan	Colebrook	Cornwall	Goshen
Hartland	Kent	Litchfield	Morris
Norfolk	North Canaan	Salisbury	Sharon
Torrington	Warren		

Waterbury				10%
6.9%				
Bethlehem	Middlebury	Naugatuck	Prospect	
Southbury	Thomaston	Waterbury	Watertown	
Wolcott	Woodbury			

EXHIBIT C

Health Insurance Portability and Accountability Act of 1996 (“HIPAA”).

- (a) If the Contactor is a Business Associate under the requirements of the Health Insurance Portability and Accountability Act of 1996 (“HIPAA”), the Contractor must comply with all terms and conditions of this Section of the Contract. If the Contractor is not a Business Associate under HIPAA, this Section of the Contract does not apply to the Contractor for this Contract.
- (b) The Contractor is required to safeguard the use, publication and disclosure of information on all applicants for, and all clients who receive, services under the Contract in accordance with all applicable federal and state law regarding confidentiality, which includes but is not limited to HIPAA, more specifically with the Privacy and Security Rules at 45 C.F.R. Part 160 and Part 164, subparts A, C, and E; and
- (c) The State of Connecticut Agency named on page 1 of this Contract (hereinafter the “Department”) is a “covered entity” as that term is defined in 45 C.F.R. § 160.103; and
- (d) The Contractor, on behalf of the Department, performs functions that involve the use or disclosure of “individually identifiable health information,” as that term is defined in 45 C.F.R. § 160.103; and
- (e) The Contractor is a “business associate” of the Department, as that term is defined in 45 C.F.R. § 160.103; and
- (f) The Contractor and the Department agree to the following in order to secure compliance with the HIPAA, the requirements of Subtitle D of the Health Information Technology for Economic and Clinical Health Act (hereinafter the HITECH Act), (Pub. L. 111-5, sections 13400 to 13423), and more specifically with the Privacy and Security Rules at 45 C.F.R. Part 160 and Part 164, subparts A, C, and E.
- (g) Definitions
 - (1) “Breach shall have the same meaning as the term is defined in section 13400 of the HITECH Act (42 U.S.C. §17921(1))
 - (2) “Business Associate” shall mean the Contractor.
 - (3) “Covered Entity” shall mean the Department of the State of Connecticut named on page 1 of this Contract.
 - (4) “Designated Record Set” shall have the same meaning as the term “designated record set” in 45 C.F.R. § 164.501.
 - (5) “Electronic Health Record” shall have the same meaning as the term is defined in section 13400 of the HITECH Act (42 U.S.C. §17921(5))

- (6) "Individual" shall have the same meaning as the term "individual" in 45 C.F.R. § 160.103 and shall include a person who qualifies as a personal representative as defined in 45 C.F.R. § 164.502(g).
 - (7) "Privacy Rule" shall mean the Standards for Privacy of Individually Identifiable Health Information at 45 C.F.R. part 160 and parts 164, subparts A and E.
 - (8) "Protected Health Information" or "PHI" shall have the same meaning as the term "protected health information" in 45 C.F.R. § 160.103, limited to information created or received by the Business Associate from or on behalf of the Covered Entity.
 - (9) "Required by Law" shall have the same meaning as the term "required by law" in 45 C.F.R. § 164.103.
 - (10) "Secretary" shall mean the Secretary of the Department of Health and Human Services or his designee.
 - (11) "More stringent" shall have the same meaning as the term "more stringent" in 45 C.F.R. § 160.202.
 - (12) "This Section of the Contract" refers to the HIPAA Provisions stated herein, in their entirety.
 - (13) "Security Incident" shall have the same meaning as the term "security incident" in 45 C.F.R. § 164.304.
 - (14) "Security Rule" shall mean the Security Standards for the Protection of Electronic Protected Health Information at 45 C.F.R. part 160 and parts 164, subpart A and C.
 - (15) "Unsecured protected health information" shall have the same meaning as the term as defined in section 13402(h)(1)(A) of HITECH. Act. (42 U.S.C. § 17932(h)(1)(A)).
- (h) Obligations and Activities of Business Associates.
- (1) Business Associate agrees not to use or disclose PHI other than as permitted or required by this Section of the Contract or as Required by Law.
 - (2) Business Associate agrees to use appropriate safeguards to prevent use or disclosure of PHI other than as provided for in this Section of the Contract.
 - (3) Business Associate agrees to use administrative, physical and technical safeguards that reasonably and appropriately protect the confidentiality, integrity, and availability of electronic protected health information that it creates, receives, maintains, or transmits on behalf of the Covered Entity.
 - (4) Business Associate agrees to mitigate, to the extent practicable, any harmful effect that is known to the Business Associate of a use or disclosure of PHI by Business Associate in violation of this Section of the Contract.

- (5) Business Associate agrees to report to Covered Entity any use or disclosure of PHI not provided for by this Section of the Contract or any security incident of which it becomes aware.
- (6) Business Associate agrees to insure that any agent, including a subcontractor, to whom it provides PHI received from, or created or received by Business Associate, on behalf of the Covered Entity, agrees to the same restrictions and conditions that apply through this Section of the Contract to Business Associate with respect to such information.
- (7) Business Associate agrees to provide access, at the request of the Covered Entity, and in the time and manner agreed to by the parties, to PHI in a Designated Record Set, to Covered Entity or, as directed by Covered Entity, to an Individual in order to meet the requirements under 45 C.F.R. § 164.524.
- (8) Business Associate agrees to make any amendments to PHI in a Designated Record Set that the Covered Entity directs or agrees to pursuant to 45 C.F.R. § 164.526 at the request of the Covered Entity, and in the time and manner agreed to by the parties.
- (9) Business Associate agrees to make internal practices, books, and records, including policies and procedures and PHI, relating to the use and disclosure of PHI received from, or created or received by, Business Associate on behalf of Covered Entity, available to Covered Entity or to the Secretary in a time and manner agreed to by the parties or designated by the Secretary, for purposes of the Secretary determining Covered Entity's compliance with the Privacy Rule.
- (10) Business Associate agrees to document such disclosures of PHI and information related to such disclosures as would be required for Covered Entity to respond to a request by an Individual for an accounting of disclosures of PHI in accordance with 45 C.F.R. § 164.528 and section 13405 of the HITECH Act (42 U.S.C. § 17935) and any regulations promulgated thereunder.
- (11) Business Associate agrees to provide to Covered Entity, in a time and manner agreed to by the parties, information collected in accordance with clause h. (10) of this Section of the Contract, to permit Covered Entity to respond to a request by an Individual for an accounting of disclosures of PHI in accordance with 45 C.F.R. § 164.528 and section 13405 of the HITECH Act (42 U.S.C. § 17935) and any regulations promulgated thereunder. Business Associate agrees at the Covered Entity's direction to provide an accounting of disclosures of PHI directly to an individual in accordance with 45 C.F.R. § 164.528 and section 13405 of the HITECH Act (42 U.S.C. § 17935) and any regulations promulgated thereunder.
- (12) Business Associate agrees to comply with any state or federal law that is more stringent than the Privacy Rule.
- (13) Business Associate agrees to comply with the requirements of the HITECH Act relating to privacy and security that are applicable to the Covered Entity and with the requirements of 45 C.F.R. sections 164.504(e), 164.308, 164.310, 164.312, and 164.316.

- (14) In the event that an individual requests that the Business Associate (a) restrict disclosures of PHI; (b) provide an accounting of disclosures of the individual's PHI; or (c) provide a copy of the individual's PHI in an electronic health record, the Business Associate agrees to notify the covered entity, in writing, within two business days of the request.
- (15) Business Associate agrees that it shall not, directly or indirectly, receive any remuneration in exchange for PHI of an individual without (1) the written approval of the covered entity, unless receipt of remuneration in exchange for PHI is expressly authorized by this Contract and (2) the valid authorization of the individual, except for the purposes provided under section 13405(d)(2) of the HITECH Act,(42 U.S.C. § 17935(d)(2)) and in any accompanying regulations

(16) Obligations in the Event of a Breach

- A. The Business Associate agrees that, following the discovery of a breach of unsecured protected health information, it shall notify the Covered Entity of such breach in accordance with the requirements of section 13402 of HITECH (42 U.S.C. 17932(b) and the provisions of this Section of the Contract.
- B. Such notification shall be provided by the Business Associate to the Covered Entity without unreasonable delay, and in no case later than 30 days after the breach is discovered by the Business Associate, except as otherwise instructed in writing by a law enforcement official pursuant to section 13402 (g) of HITECH (42 U.S.C. 17932(g)) . A breach is considered discovered as of the first day on which it is, or reasonably should have been, known to the Business Associate. The notification shall include the identification and last known address, phone number and email address of each individual (or the next of kin of the individual if the individual is deceased) whose unsecured protected health information has been, or is reasonably believed by the Business Associate to have been, accessed, acquired, or disclosed during such breach.
- C. The Business Associate agrees to include in the notification to the Covered Entity at least the following information:
1. A brief description of what happened, including the date of the breach and the date of the discovery of the breach, if known.
 2. A description of the types of unsecured protected health information that were involved in the breach (such as full name, Social Security number, date of birth, home address, account number, or disability code).
 3. The steps the Business Associate recommends that individuals take to protect themselves from potential harm resulting from the breach.
 4. A detailed description of what the Business Associate is doing to investigate the breach, to mitigate losses, and to protect against any further breaches.
 5. Whether a law enforcement official has advised either verbally or in writing the Business Associate that he or she has determined that notification or notice to

individuals or the posting required under section 13402 of the HITECH Act would impede a criminal investigation or cause damage to national security and; if so, include contact information for said official.

- D. Business Associate agrees to provide appropriate staffing and have established procedures to ensure that individuals informed by the Covered Entity of a breach by the Business Associate have the opportunity to ask questions and contact the Business Associate for additional information regarding the breach. Such procedures shall include a toll-free telephone number, an e-mail address, a posting on its Web site and a postal address. Business Associate agrees to include in the notification of a breach by the Business Associate to the Covered Entity, a written description of the procedures that have been established to meet these requirements. Costs of such contact procedures will be borne by the Contractor.
 - E. Business Associate agrees that, in the event of a breach, it has the burden to demonstrate that it has complied with all notifications requirements set forth above, including evidence demonstrating the necessity of a delay in notification to the Covered Entity.
- (i) Permitted Uses and Disclosure by Business Associate.
- (1) General Use and Disclosure Provisions Except as otherwise limited in this Section of the Contract, Business Associate may use or disclose PHI to perform functions, activities, or services for, or on behalf of, Covered Entity as specified in this Contract, provided that such use or disclosure would not violate the Privacy Rule if done by Covered Entity or the minimum necessary policies and procedures of the Covered Entity.
 - (2) Specific Use and Disclosure Provisions
 - (A) Except as otherwise limited in this Section of the Contract, Business Associate may use PHI for the proper management and administration of Business Associate or to carry out the legal responsibilities of Business Associate.
 - (B) Except as otherwise limited in this Section of the Contract, Business Associate may disclose PHI for the proper management and administration of Business Associate, provided that disclosures are Required by Law, or Business Associate obtains reasonable assurances from the person to whom the information is disclosed that it will remain confidential and used or further disclosed only as Required by Law or for the purpose for which it was disclosed to the person, and the person notifies Business Associate of any instances of which it is aware in which the confidentiality of the information has been breached.
 - (C) Except as otherwise limited in this Section of the Contract, Business Associate may use PHI to provide Data Aggregation services to Covered Entity as permitted by 45 C.F.R. § 164.504(e)(2)(i)(B).
- (j) Obligations of Covered Entity.

- (1) Covered Entity shall notify Business Associate of any limitations in its notice of privacy practices of Covered Entity, in accordance with 45 C.F.R. § 164.520, or to the extent that such limitation may affect Business Associate's use or disclosure of PHI.
 - (2) Covered Entity shall notify Business Associate of any changes in, or revocation of, permission by Individual to use or disclose PHI, to the extent that such changes may affect Business Associate's use or disclosure of PHI.
 - (3) Covered Entity shall notify Business Associate of any restriction to the use or disclosure of PHI that Covered Entity has agreed to in accordance with 45 C.F.R. § 164.522, to the extent that such restriction may affect Business Associate's use or disclosure of PHI.
- (k) Permissible Requests by Covered Entity. Covered Entity shall not request Business Associate to use or disclose PHI in any manner that would not be permissible under the Privacy Rule if done by the Covered Entity, except that Business Associate may use and disclose PHI for data aggregation, and management and administrative activities of Business Associate, as permitted under this Section of the Contract.
- (l) Term and Termination.
- (1) Term. The Term of this Section of the Contract shall be effective as of the date the Contract is effective and shall terminate when the information collected in accordance with clause h. (10) of this Section of the Contract is provided to the Covered Entity and all of the PHI provided by Covered Entity to Business Associate, or created or received by Business Associate on behalf of Covered Entity, is destroyed or returned to Covered Entity, or, if it is infeasible to return or destroy PHI, protections are extended to such information, in accordance with the termination provisions in this Section.
 - (2) Termination for Cause Upon Covered Entity's knowledge of a material breach by Business Associate, Covered Entity shall either:
 - (A) Provide an opportunity for Business Associate to cure the breach or end the violation and terminate the Contract if Business Associate does not cure the breach or end the violation within the time specified by the Covered Entity; or
 - (B) Immediately terminate the Contract if Business Associate has breached a material term of this Section of the Contract and cure is not possible; or
 - (C) If neither termination nor cure is feasible, Covered Entity shall report the violation to the Secretary.
 - (3) Effect of Termination
 - (A) Except as provided in (l)(2) of this Section of the Contract, upon termination of this Contract, for any reason, Business Associate shall return or destroy all PHI received from Covered Entity, or created or received by Business Associate on behalf of Covered Entity. Business Associate shall also provide the information collected in accordance with clause h. (10) of this Section of the Contract to the Covered Entity

within ten business days of the notice of termination. This provision shall apply to PHI that is in the possession of subcontractors or agents of Business Associate. Business Associate shall retain no copies of the PHI.

(B) In the event that Business Associate determines that returning or destroying the PHI is infeasible, Business Associate shall provide to Covered Entity notification of the conditions that make return or destruction infeasible. Upon documentation by Business Associate that return or destruction of PHI is infeasible, Business Associate shall extend the protections of this Section of the Contract to such PHI and limit further uses and disclosures of PHI to those purposes that make return or destruction infeasible, for as long as Business Associate maintains such PHI. Infeasibility of the return or destruction of PHI includes, but is not limited to, requirements under state or federal law that the Business Associate maintains or preserves the PHI or copies thereof.

(m) Miscellaneous Provisions.

- (1) Regulatory References. A reference in this Section of the Contract to a section in the Privacy Rule means the section as in effect or as amended.
- (2) Amendment. The Parties agree to take such action as is necessary to amend this Section of the Contract from time to time as is necessary for Covered Entity to comply with requirements of the Privacy Rule and the Health Insurance Portability and Accountability Act of 1996, Pub. L. No. 104-191.
- (3) Survival. The respective rights and obligations of Business Associate shall survive the termination of this Contract.
- (4) Effect on Contract. Except as specifically required to implement the purposes of this Section of the Contract, all other terms of the Contract shall remain in force and effect.
- (5) Construction. This Section of the Contract shall be construed as broadly as necessary to implement and comply with the Privacy Standard. Any ambiguity in this Section of the Contract shall be resolved in favor of a meaning that complies, and is consistent with, the Privacy Standard.
- (6) Disclaimer. Covered Entity makes no warranty or representation that compliance with this Section of the Contract will be adequate or satisfactory for Business Associate's own purposes. Covered Entity shall not be liable to Business Associate for any claim, civil or criminal penalty, loss or damage related to or arising from the unauthorized use or disclosure of PHI by Business Associate or any of its officers, directors, employees, contractors or agents, or any third party to whom Business Associate has disclosed PHI contrary to the provisions of this Contract or applicable law. Business Associate is solely responsible for all decisions made, and actions taken, by Business Associate regarding the safeguarding, use and disclosure of PHI within its possession, custody or control.

(7) Indemnification. The Business Associate shall indemnify and hold the Covered Entity harmless from and against any and all claims, liabilities, judgments, fines, assessments, penalties, awards and any statutory damages that may be imposed or assessed pursuant to HIPAA, as amended or the

HITECH Act, including, without limitation, attorney's fees, expert witness fees, costs of investigation, litigation or dispute resolution, and costs awarded thereunder, relating to or arising out of any violation by the Business Associate and its agents, including subcontractors, of any obligation of Business Associate and its agents, including subcontractors, under this section of the contract, under HIPAA, the HITECH Act, the Privacy Rule and the Security Rule.

Notice to Executive Branch State Contractors and Prospective State Contractors of Campaign Contribution and Solicitation Limitations

This notice is provided under the authority of Connecticut General Statutes §9-612(g)(2), as amended by P.A. 10-1, and is for the purpose of informing state contractors and prospective state contractors of the following law (*italicized words are defined on the reverse side of this page*).

CAMPAIGN CONTRIBUTION AND SOLICITATION LIMITATIONS

No *state contractor, prospective state contractor, principal of a state contractor or principal of a prospective state contractor*, with regard to a *state contract or state contract solicitation* with or from a state agency in the executive branch or a quasi-public agency or a holder, or principal of a holder of a valid prequalification certificate, shall make a contribution to (i) an exploratory committee or candidate committee established by a candidate for nomination or election to the office of Governor, Lieutenant Governor, Attorney General, State Comptroller, Secretary of the State or State Treasurer, (ii) a political committee authorized to make contributions or expenditures to or for the benefit of such candidates, or (iii) a party committee (which includes town committees).

In addition, no holder or principal of a holder of a valid prequalification certificate, shall make a contribution to (i) an exploratory committee or candidate committee established by a candidate for nomination or election to the office of State senator or State representative, (ii) a political committee authorized to make contributions or expenditures to or for the benefit of such candidates, or (iii) a party committee.

On and after January 1, 2011, no state contractor, prospective state contractor, principal of a state contractor or principal of a prospective state contractor, with regard to a state contract or state contract solicitation with or from a state agency in the executive branch or a quasi-public agency or a holder, or principal of a holder of a valid prequalification certificate, shall **knowingly solicit** contributions from the state contractor's or prospective state contractor's employees or from a *subcontractor or principals of the subcontractor* on behalf of (i) an exploratory committee or candidate committee established by a candidate for nomination or election to the office of Governor, Lieutenant Governor, Attorney General, State Comptroller, Secretary of the State or State Treasurer, (ii) a political committee authorized to make contributions or expenditures to or for the benefit of such candidates, or (iii) a party committee.

DUTY TO INFORM

State contractors and prospective state contractors are required to inform their principals of the above prohibitions, as applicable, and the possible penalties and other consequences of any violation thereof.

PENALTIES FOR VIOLATIONS

Contributions or solicitations of contributions made in violation of the above prohibitions may result in the following civil and criminal penalties:

Civil penalties—Up to \$2,000 or twice the amount of the prohibited contribution, whichever is greater, against a principal or a contractor. Any state contractor or prospective state contractor which fails to make reasonable efforts to comply with the provisions requiring notice to its principals of these prohibitions and the possible consequences of their violations may also be subject to civil penalties of up to \$2,000 or twice the amount of the prohibited contributions made by their principals.

Criminal penalties—Any knowing and willful violation of the prohibition is a Class D felony, which may subject the violator to imprisonment of not more than 5 years, or not more than \$5,000 in fines, or both.

CONTRACT CONSEQUENCES

In the case of a state contractor, contributions made or solicited in violation of the above prohibitions may result in the contract being voided.

In the case of a prospective state contractor, contributions made or solicited in violation of the above prohibitions shall result in the contract described in the state contract solicitation not being awarded to the prospective state contractor, unless the State Elections Enforcement Commission determines that mitigating circumstances exist concerning such violation.

The State shall not award any other state contract to anyone found in violation of the above prohibitions for a period of one year after the election for which such contribution is made or solicited, unless the State Elections Enforcement Commission determines that mitigating circumstances exist concerning such violation.

Additional information may be found on the website of the State Elections Enforcement Commission, www.ct.gov/seec. Click on the link to "Lobbyist/Contractor Limitations."

DEFINITIONS

“State contractor” means a person, business entity or nonprofit organization that enters into a state contract. Such person, business entity or nonprofit organization shall be deemed to be a state contractor until December thirty-first of the year in which such contract terminates. “State contractor” does not include a municipality or any other political subdivision of the state, including any entities or associations duly created by the municipality or political subdivision exclusively amongst themselves to further any purpose authorized by statute or charter, or an employee in the executive or legislative branch of state government or a quasi-public agency, whether in the classified or unclassified service and full or part-time, and only in such person’s capacity as a state or quasi-public agency employee.

“Prospective state contractor” means a person, business entity or nonprofit organization that (i) submits a response to a state contract solicitation by the state, a state agency or a quasi-public agency, or a proposal in response to a request for proposals by the state, a state agency or a quasi-public agency, until the contract has been entered into, or (ii) holds a valid prequalification certificate issued by the Commissioner of Administrative Services under section 4a-100. “Prospective state contractor” does not include a municipality or any other political subdivision of the state, including any entities or associations duly created by the municipality or political subdivision exclusively amongst themselves to further any purpose authorized by statute or charter, or an employee in the executive or legislative branch of state government or a quasi-public agency, whether in the classified or unclassified service and full or part-time, and only in such person’s capacity as a state or quasi-public agency employee.

“Principal of a state contractor or prospective state contractor” means (i) any individual who is a member of the board of directors of, or has an ownership interest of five per cent or more in, a state contractor or prospective state contractor, which is a business entity, except for an individual who is a member of the board of directors of a nonprofit organization, (ii) an individual who is employed by a state contractor or prospective state contractor, which is a business entity, as president, treasurer or executive vice president, (iii) an individual who is the chief executive officer of a state contractor or prospective state contractor, which is not a business entity, or if a state contractor or prospective state contractor has no such officer, then the officer who duly possesses comparable powers and duties, (iv) an officer or an employee of any state contractor or prospective state contractor who has *managerial or discretionary responsibilities with respect to a state contract*, (v) the spouse or a *dependent child* who is eighteen years of age or older of an individual described in this subparagraph, or (vi) a political committee established or controlled by an individual described in this subparagraph or the business entity or nonprofit organization that is the state contractor or prospective state contractor.

“State contract” means an agreement or contract with the state or any state agency or any quasi-public agency, let through a procurement process or otherwise, having a value of fifty thousand dollars or more, or a combination or series of such agreements or contracts having a value of one hundred thousand dollars or more in a calendar year, for (i) the rendition of services, (ii) the furnishing of any goods, material, supplies, equipment or any items of any kind, (iii) the construction, alteration or repair of any public building or public work, (iv) the acquisition, sale or lease of any land or building, (v) a licensing arrangement, or (vi) a grant, loan or loan guarantee. “State contract” does not include any agreement or contract with the state, any state agency or any quasi-public agency that is exclusively federally funded, an education loan, a loan to an individual for other than commercial purposes or any agreement or contract between the state or any state agency and the United States Department of the Navy or the United States Department of Defense.

“State contract solicitation” means a request by a state agency or quasi-public agency, in whatever form issued, including, but not limited to, an invitation to bid, request for proposals, request for information or request for quotes, inviting bids, quotes or other types of submittals, through a competitive procurement process or another process authorized by law waiving competitive procurement.

“Managerial or discretionary responsibilities with respect to a state contract” means having direct, extensive and substantive responsibilities with respect to the negotiation of the state contract and not peripheral, clerical or ministerial responsibilities.

“Dependent child” means a child residing in an individual’s household who may legally be claimed as a dependent on the federal income tax of such individual.

“Solicit” means (A) requesting that a contribution be made, (B) participating in any fund-raising activities for a candidate committee, exploratory committee, political committee or party committee, including, but not limited to, forwarding tickets to potential contributors, receiving contributions for transmission to any such committee or bundling contributions, (C) serving as chairperson, treasurer or deputy treasurer of any such committee, or (D) establishing a political committee for the sole purpose of soliciting or receiving contributions for any committee. Solicit does not include: (i) making a contribution that is otherwise permitted by Chapter 155 of the Connecticut General Statutes; (ii) informing any person of a position taken by a candidate for public office or a public official, (iii) notifying the person of any activities of, or contact information for, any candidate for public office; or (iv) serving as a member in any party committee or as an officer of such committee that is not otherwise prohibited in this section.

“Subcontractor” means any person, business entity or nonprofit organization that contracts to perform part or all of the obligations of a state contractor’s state contract. Such person, business entity or nonprofit organization shall be deemed to be a subcontractor until December thirty first of the year in which the subcontract terminates. “Subcontractor” does not include (i) a municipality or any other political subdivision of the state, including any entities or associations duly created by the municipality or political subdivision exclusively amongst themselves to further any purpose authorized by statute or charter, or (ii) an employee in the executive or legislative branch of state government or a quasi-public agency, whether in the classified or unclassified service and full or part-time, and only in such person’s capacity as a state or quasi-public agency employee.

“Principal of a subcontractor” means (i) any individual who is a member of the board of directors of, or has an ownership interest of five per cent or more in, a subcontractor, which is a business entity, except for an individual who is a member of the board of directors of a nonprofit organization, (ii) an individual who is employed by a subcontractor, which is a business entity, as president, treasurer or executive vice president, (iii) an individual who is the chief executive officer of a subcontractor, which is not a business entity, or if a subcontractor has no such officer, then the officer who duly possesses comparable powers and duties, (iv) an officer or an employee of any subcontractor who has managerial or discretionary responsibilities with respect to a subcontract with a state contractor, (v) the spouse or a dependent child who is eighteen years of age or older of an individual described in this subparagraph, or (vi) a political committee established or controlled by an individual described in this subparagraph or the business entity or nonprofit organization that is the subcontractor.

EXHIBIT E

(state wages will be inserted here)